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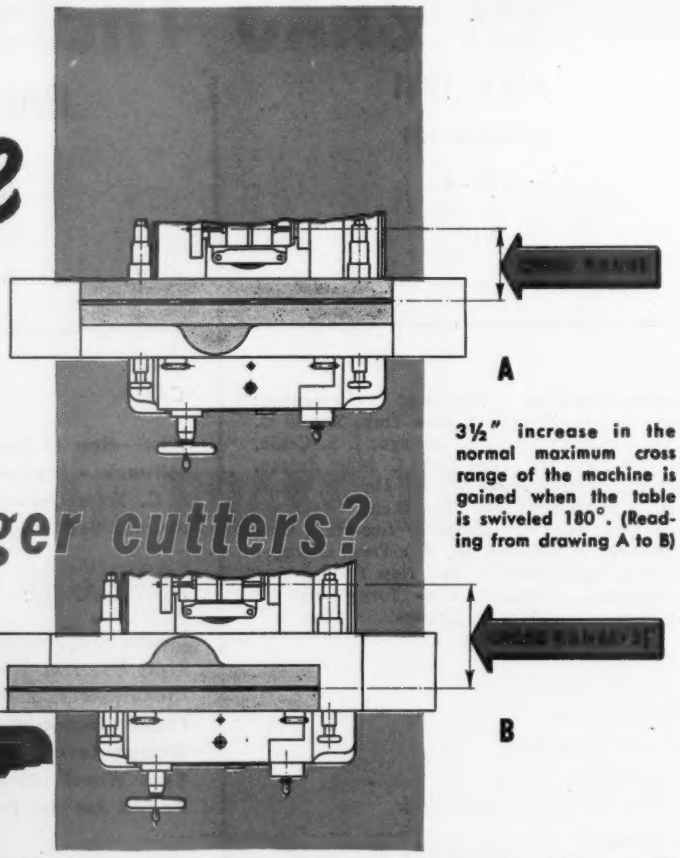

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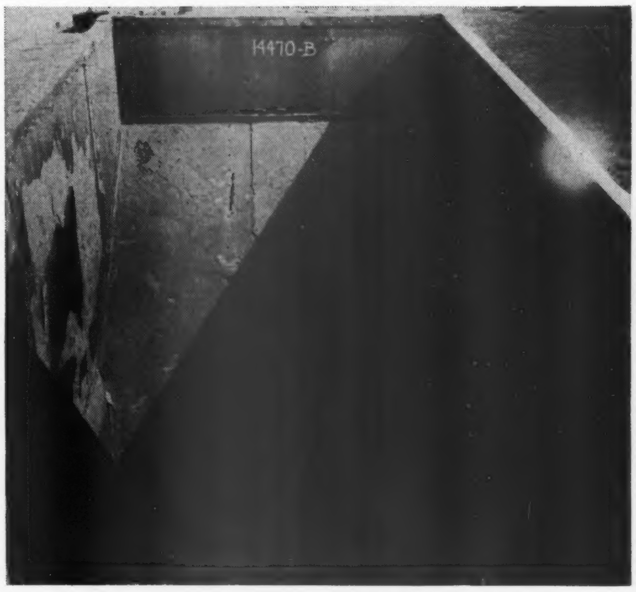
RUST—How to Combat It by Proper Design*



Materials having alloys which experience has proved will delay the destructive effects of corrosion can be made to last still longer if the designer uses good judgment

By H. Malcolm Priest†

MANY people are keenly aware of the fact that corrosion is the source of serious economic loss and waste of natural resources. Others are actively concerned with the reduction of these losses and much research has been devoted to the fundamental aspects of the problem. Enlightened design can make an effective contribution, although it can seldom be expected to eliminate the deleterious effects of corrosion. Nevertheless, design should always seek to control or minimize these effects.

The steel industry has sought one approach to the corrosion problem through the chemical composition of the steel. Beginning with structural carbon steel, it has developed other grades, with increasing resistance to corrosion, that progress through copper steel, high-strength, low-alloy steels, to the stainless steels.

The increased corrosion resistance is obtained by the addition to the steel of alloying elements which at the same time increase the cost. Consequently, the final selection of a steel depends upon a balance between the desired corrosion resistance and willingness to pay the extra cost involved. Until recent years, copper steel had been used almost exclusively in railroad car construction when added corrosion resistance was essential. A further advance was provided by some of the high-strength steels whose superior corrosion resisting properties, accompanied by the added advantage of greater strength with only a moderate cost premium, have given these steels an increasing acceptance in the railroad, as well as in many other fields.

Various familiar means have long been utilized for protecting steel against the ravages of corrosion. The most common are painting, galvanizing, tinplating, or the application of asphaltic and other compounds. The function of these methods is to interpose essentially neutral substances between the steel and the corroding media. At best, they but delay the inevitable attack unless an unbroken protective coating can be continuously maintained.

Designing engineers have often endeavored to obtain longer life from structures by adding an arbitrary amount to the thickness of material to allow for corrosion, or by specifying some minimum thickness regardless of strength requirements. In other cases, where strength is a secondary factor, the thickness has been determined on the basis of the rate of corrosion as found from experience with the type of structure under consid-

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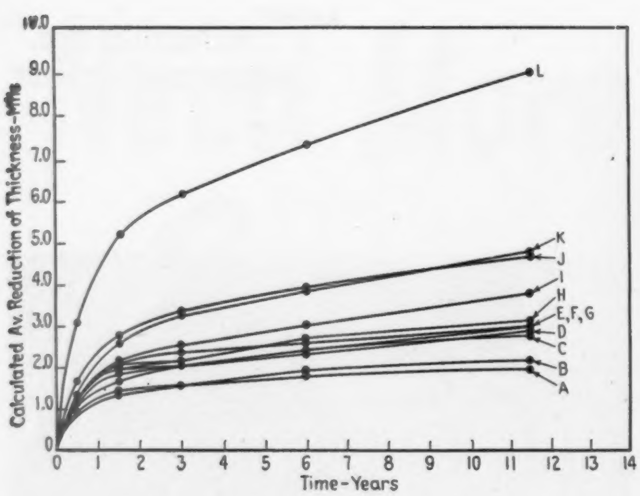


Fig. 1—Time corrosion curves for steels in industrial atmosphere at Kearny, N. J.

eration. Such methods as these are not without merit but they do not go to the real root of the trouble. They are an acceptance of existing conditions rather than a remedy such as may be obtained through improved design. There is greater warrant for them when the possibilities of design have been exhausted.

There is a wider realization today that construction details play a role in corrosion, whenever they provide conditions that accelerate the action. The control of these construction details lies very largely in the realm of design, which is the specific subject of this discussion. Design is concerned more with the fact than with the theory of corrosion.

Corrosion is defined as "destruction of a metal by chemical or electro-chemical reaction with its environment." The amount of corrosion depends on the composition of the metal and the environment. The effects on various grades of steel corroded on test racks in an industrial atmosphere are plotted in Fig. 1. Steel *L* is a structural steel with a low residual copper content. Steel *K* is a structural copper steel. The remainder represents the high-strength, low-alloy steels made by various manufacturers in 1938.

It is noticeable that after three years of exposure the steels corroded at essentially linear rates. During the first three years the protective rusts are being developed and the corrosion rates are non-linear and relatively high. It is also noteworthy that the better grades of steel acquire a uniformly protective rust film earlier than does structural steel *L*. The rust films on steel are much more protective when they are developed under alternate wet and dry conditions than under continuously moist conditions.

On test racks, specimens wet by dew and rain become periodically dry and may remain so for a considerable percentage of the time. According to the generally accepted electrochemical theory of corrosion, steel can corrode only when there is at least a film of moisture on the metal surface. Therefore, it behooves us to so design our steel structures that the surface remains wet for minimum lengths of time.

Whenever the protective rust coating is removed by erosion or cracked by bending, a fresh metal surface is exposed to corrosion. The rate of loss is again the same as indicated at the left-hand end of the chart in Fig. 1. Thus it is readily seen why mechanical action is often conducive to accelerated corrosion.

Fig. 2—Side sheet corroded through along vertical leg of side-sill angle and vertically along inside side stake. Sheet gaping open about 2½ in.

Most technological advances have been made through the careful and painstaking accumulation and study of data obtained from observations and tests. Not the least of these advances have been contributed by failures. There is a curious reluctance at times to discuss failures, as though they were like skeletons in a closet. In reality, they have been the source of some of the most valuable information and have contributed immeasurably to the progress of science and the improvement of many arts.

An excellent way to approach the subject of designing against corrosion is to observe actual conditions and to seek explanations of any unusual rates of corrosion. Inevitably, we shall deal with failures,—normal failures, they might be called—and shall examine them only with a view to extending the time before they occur.

Hopper Car Design

Let us begin with the ordinary hopper car—a type of car in which problems of corrosion are numerous. Railroad mechanical people are all too familiar with the condition illustrated in the photograph of Fig. 2. The first question that comes to mind is—"Why did this failure occur?"—and before any answer can be given, we must gather more facts about conditions.

At the conclusion of an investigation of the service life of various steels in hopper cars, the side sheets from several cars were removed, cleaned and gaged for thickneed, with the results depicted in Fig. 3-A. From the top bulb angle to the side sill there was an increasing loss which parallels, in a general manner, the increase in horizontal pressure of the lading of coal, shown in Fig. 3-B. The outward pressure creates bending stresses in the side sheet and also augments the frictional or erosive action of the lading during the unloading operation. Both of these mechanical actions vary directly with the pressure, and their effect might be expected to be more pronounced toward the side sill.

We need to look closely at the detail arrangement of the structure at the side sill where the most common construction is that shown in Fig. 4-A. The significant feature to note is the ledge or shelf formed by the top

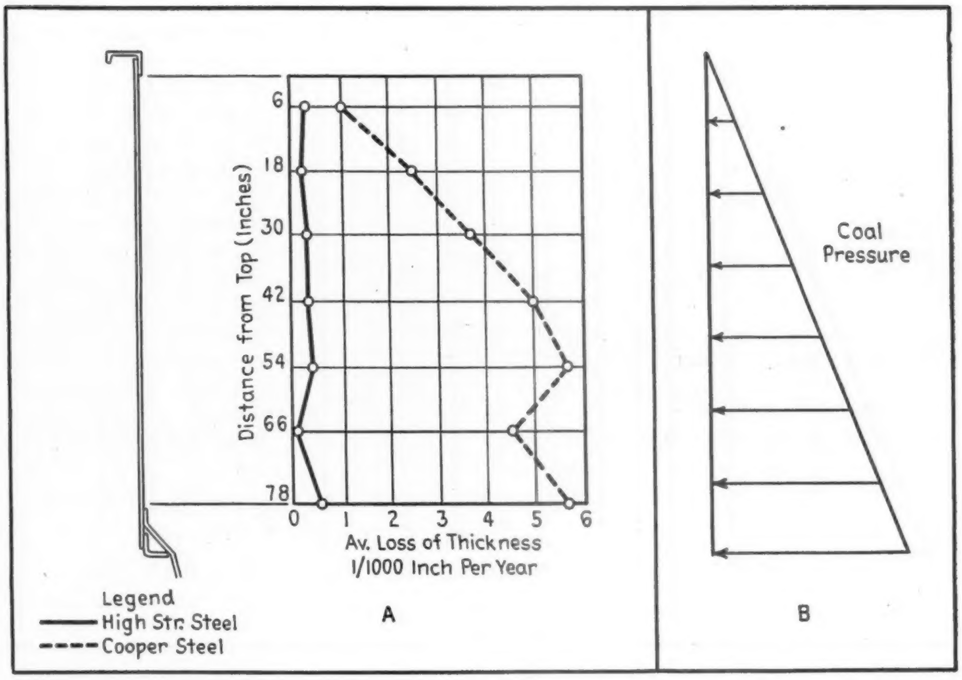


Fig. 3 — Corrosion loss in side sheets

edges of the sill angle and the hopper sheet. This ledge retains dirt and powdered coal that trap moisture and coal leachings. Clearly, there are conditions in the region of the side sill that can and do contribute to the failure locally when other portions of the sheet, only a few inches away, are still relatively unaffected. Hence it is not surprising that we find the typical failures shown in Fig. 2.

About five years ago, Carnegie-Illinois Steel Corporation (now United States Steel Company) built an experimental car to demonstrate several ideas for meeting the corrosion problem. There was no thought that the car represented the ultimate in construction, rather the hope was entertained that it would stimulate wider thinking toward the development of further improvements.

Among the ideas was the side sill arrangement shown in Fig. 4-B. By way of comparison the standard construction is given in Fig. 4-A. Through redesigning, it became possible to eliminate the ledge, thereby removing one source of trouble. The new hopper cars of the Chesapeake & Ohio have the side sill detail shown in Fig. 4-C and again the ledge has been effectively eliminated. In both cars, a corrosion resisting, high-strength steel was used as an added margin of life expectancy.

Vibration is undoubtedly a contributing factor to the failures of side sheets along the edges of supporting members. There are many opportunities for investigation of problems arising from vibration in railroad rolling stock, but the subject is a very complicated one. Flat sheets, as in hopper car sides, are particularly susceptible to vibration—the effect of which is to bend the sheets most severely at the supporting edges. Every object has a natural frequency of vibration and when the exciting force is applied with the same frequency, there is a pronounced and often violent increase in the amplitude of vibration. This phenomenon is known as "resonance."

The consequences of vibration are accelerated corrosion and loss of strength from reduced sections of the sheets at the supports, where stresses are at a maximum. Wherever resonance is encountered, it is imperative to change the natural frequency, but in any case where vibration is troublesome the problem can be met in

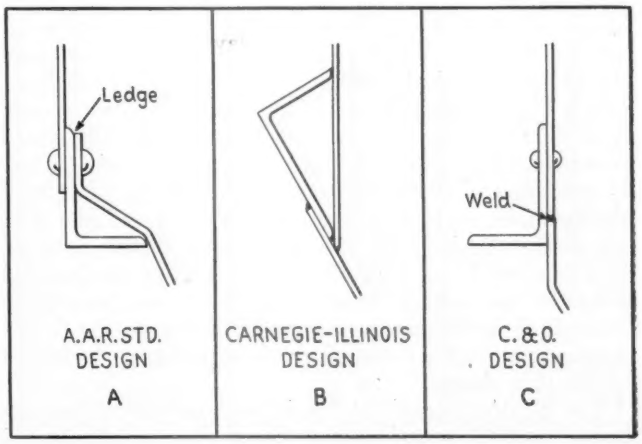


Fig. 4—Side-sill sections

several ways. The size of the flat panels may be changed by decreasing the spacing between side stakes or by adding stiffeners or corrugations to break up the panels into smaller flat areas. Increasing the thickness of the sheet will increase the frequency but decrease the amplitude of vibration and decrease the induced bending stress. No set rules can be laid down—the solution is perforce a matter of trial.

Car shakeouts for unloading hopper cars have been on the market since 1946 and their operation depends upon the vibratory action set up by revolving eccentric weights. The action is so severe as to shake the whole car body and to set the side sheets into pronounced vibration. The rust scale is not only loosened at the supported edges but over the entire area as well. As will be shown presently, the most damaging effect of the vibration arises from the bending moments at the supports. The stresses resulting from these moments are increased by the presence of a reduced thickness of material or of corrosion pits which act as stress raisers.

In 1934 the Pressed Steel Car Company brought out a 50-ton hopper car of high-strength steel, weighing only

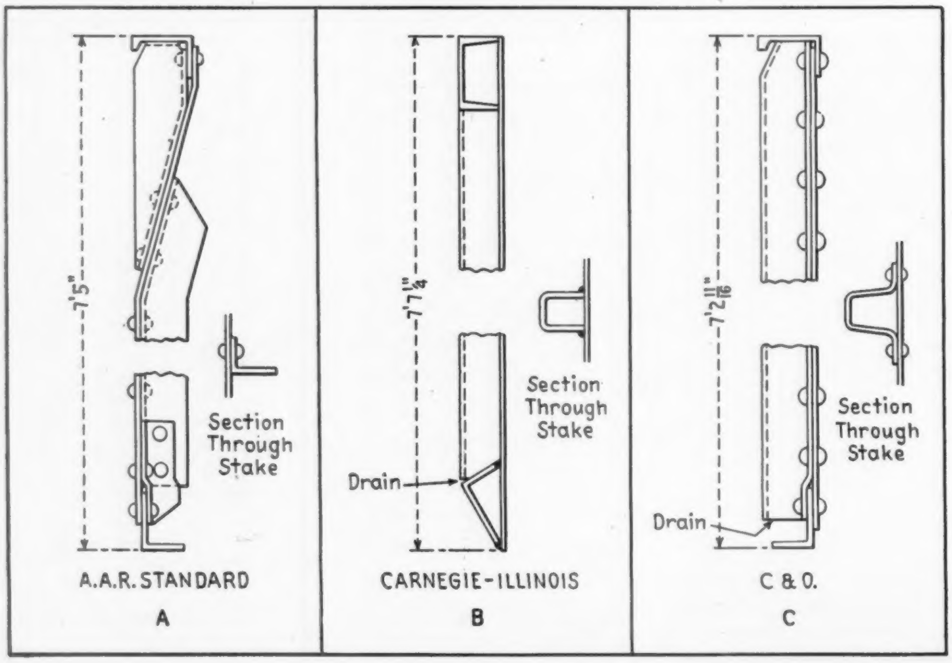


Fig. 5—Side construction

30,000 lb. The side sheets were only 3/32 inches thick as compared to standard construction with 3/16 inches sheets of copper steel. After 100 of these cars had been in service about 11 or 12 years, the typical failures along the side sill angles began to appear just above the usual ledge. This length of time to failure did not differ greatly from that in sides of 3/16 inch copper steel. The added corrosion resistance of the high-strength steel could hardly account for all of the performance of the 3/32 inch sheet. Again, we look for a possible reason and find it in the design. Each of the side panels was dished outward in a buckled form. Vibration could not flex the buckled sheets in the manner common to flat sheets, and there seems little doubt that this particular feature of the design accounts in part for the relatively superior performance of the thin sheets.

The relative merits of inside and outside stakes are worth careful consideration. From the standpoint of corrosion, inside stakes have very little in their favor. It should always be remembered that steel surfaces on the inside of a hopper car are not painted and are fully exposed to corrosive action. Inside stakes also impede the smooth flow of lading and the construction affords numerous opportunities for local corrosion.

Fig. 5 illustrates the side construction of the A.A.R. standard hopper cars with inside stakes and two other designs with outside stakes. It is evident that the construction for inside stakes is more elaborate,—requiring the forming of the side sheets, the trimming and forming of stakes and outside extensions. By contrast, the other types of construction require no forming of the sheets and the stakes are of simple form. Furthermore, the stakes can be kept painted since they are not exposed to the lading.

The smooth interiors of the Carnegie-Illinois and C. & O. designs reduce the chances for local corrosion. Contrast these types of construction with the standard design in the photograph of Fig. 6 showing an inside stake and the accumulation of dirt on ledges and in crevices.

One of the arguments against the use of outside stakes is the loss of volume which has to be made up by increasing the length of cars. A moderate increase in height—

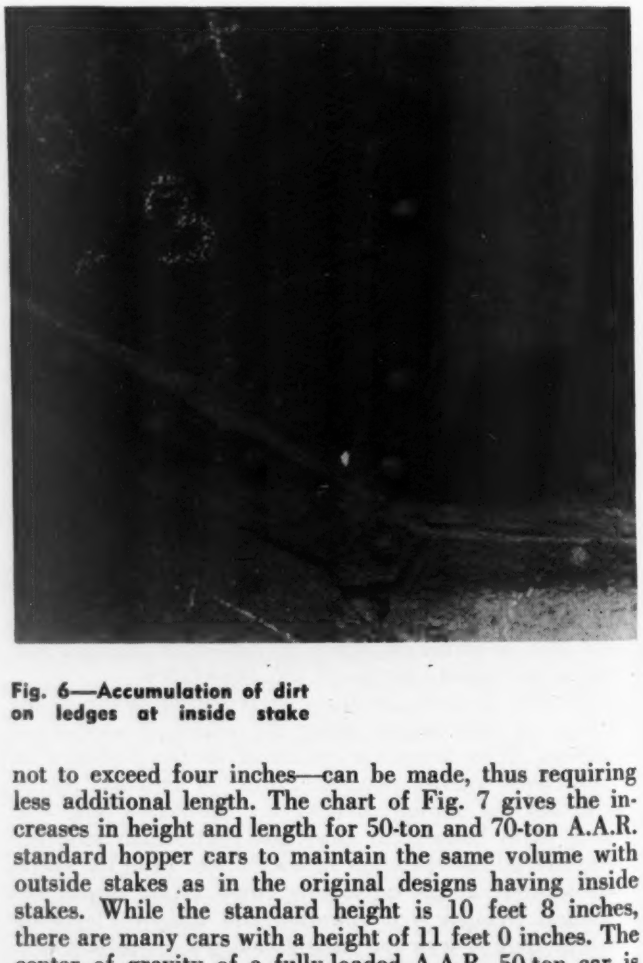


Fig. 6—Accumulation of dirt on ledges at inside stake

not to exceed four inches—can be made, thus requiring less additional length. The chart of Fig. 7 gives the increases in height and length for 50-ton and 70-ton A.A.R. standard hopper cars to maintain the same volume with outside stakes as in the original designs having inside stakes. While the standard height is 10 feet 8 inches, there are many cars with a height of 11 feet 0 inches. The center of gravity of a fully-loaded A.A.R. 50-ton car is 80⅜ inches above top of rail while the Carnegie-Illinois car with 11 feet 0 inches height had a center of gravity height of 82¾ inches.

An important point in design of stakes is to provide for drainage of any moisture from the inside. Water will seep between the faying surfaces of the stakes and sheets and collect inside unless drainage can take place. The

stake in Fig. 6 apparently has no such provision. The outside stakes in Fig. 5 have outlets as indicated. In the case of the Carnegie-Illinois car the opening was inadvertantly closed by welding. When the welds were chipped out, some of the stakes were found to have as much as two quarts of water entrapped. It had seeped in between intermittent welds connecting the stakes to the sheet.

The life of floor sheets in hopper cars is not entirely determined by corrosion. Present-day methods of unloading with clam shell buckets, building fires under cars to thaw frozen lading, and the impact of lading falling from considerable heights subject the floor to very severe abuse of a destructive character. This mechanical damage has the effect of loosening rust scale, distorting the sheets, opening joints and thereby clearing the way for fresh corrosion attack. Design must meet these conditions by providing adequate stiffness in the floor supports.

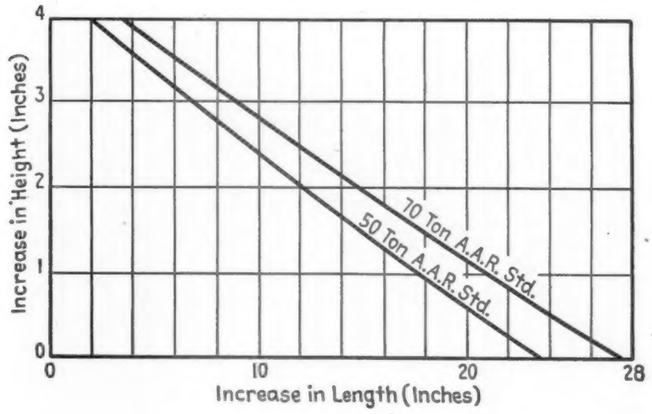


Fig. 7—Equal volumes of hopper cars

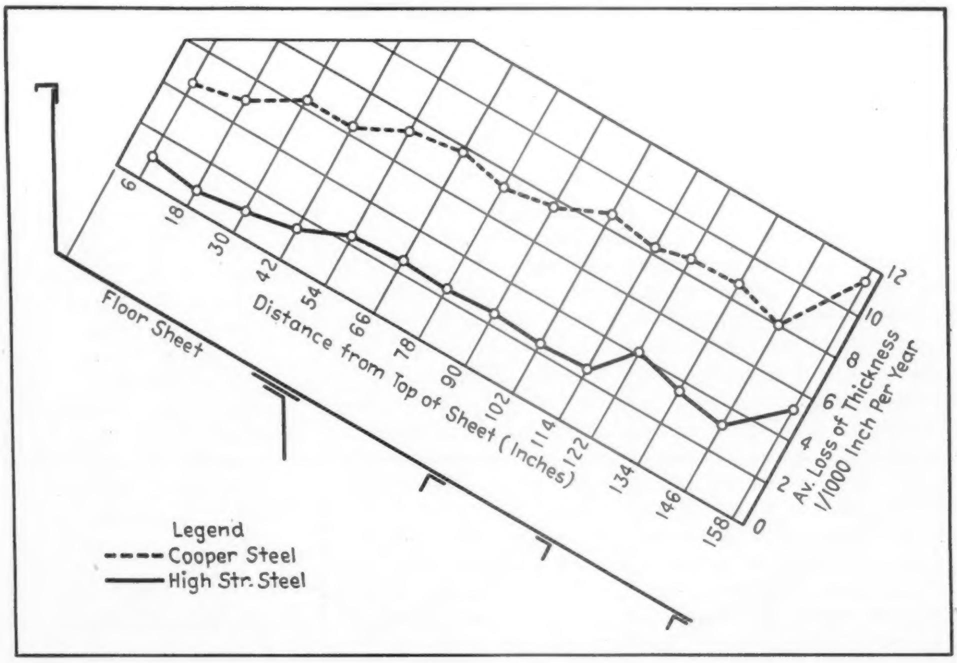


Fig. 8 — Corrosion loss in floor sheets

As in the previous discussion of side sheets, it is well to examine the nature and location of failures that commonly occur in the floors. Fig. 8 shows the losses in thickness as found in the investigation of service life of various grades of steel. One readily recognizes the increasing rate of loss from the upper end of the floor to the door opening. We have here a case where erosion plays a part. The loss is related to the depth and weight of lading and the quantity that slides over the surface of the steel. It is becoming more common practice to recognize this condition by increasing the thicknesses of the floor from the ends to the hopper chutes.

One of the striking facts about floor failures is their proximity to the supporting members. There must be a reason for this, and again it is a case where bending or flexure enters into the situation. The condition is aggravated when the flexure is accompanied by excessive deflection of the sheets, as may occur when the floor stiffeners are not adequate. This is shown in the photograph on page 43.

Fig. 9 shows a failure in a floor sheet just above an inside stake at the body bolster. The collection of dirt behind this stake, even with a small deflecting plate welded in the corner, undoubtedly contributed to the acceleration of corrosion. Then too, the flexure added its contribution with the inevitable consequences. In this particular case, the condition was further complicated by the failure of the upper floor stiffeners to function effectively—resulting in excessive deflections.

The failure of these floor stiffeners is an interesting case. They were zees extending from the end of the car to the bolster. Being of an unsymmetrical section, they eventually twisted in a manner to lose much of their strength and permitted the upper floor to sag several inches. As a part of the major repairs to these cars, the zee stiffeners have been replaced with present channels, back to back, which form symmetrical members that provide better support.

It has been noted that failures of floor sheets are more numerous at the edges of supporting members. A contributing reason for this tendency may be found from a consideration of the two cases of bending illustrated in Fig. 10-A. The plates are assumed to be fixed at the supports in both examples. The upper sketch shows a plate being bent downward over a rigid support and it should be noted that the bending effect is concentrated

Fig. 9—Failure of floor at bolster stake

the floor is supported on a thick and comparatively rigid beam flange and will be bent more sharply at the edges.

The construction shown in Sketch D is similiar to that shown in the car on page 43 where it will be seen that the failure was at the lower edge of the bolster flange plate. While the floor sheet at edge *B* has an intermediate support, the cantilever portion of the flange plate may have been short enough to have had considerable rigidity.

An improved detail is illustrated in Sketch E, (Fig. 10) in which all the lapping of the floor sheets is over the bolster flange, concentrating the rigidity there and giving intermediate support to the floor at edges *A* and *B*.

Another attempt to provide flexibility at the bolster is shown in Sketch F and is the construction used in the Carnegie-Illinois experimental hopper car. Bending of the flange of the beam bolster was avoided in favor of press-brake forming of what might be called a bolster extension. The vertical leg and flanges of this extension were intended to relieve the stress concentration.

In all of these sketches, the reader should keep in mind the erosion to which floors are subjected and relate it to

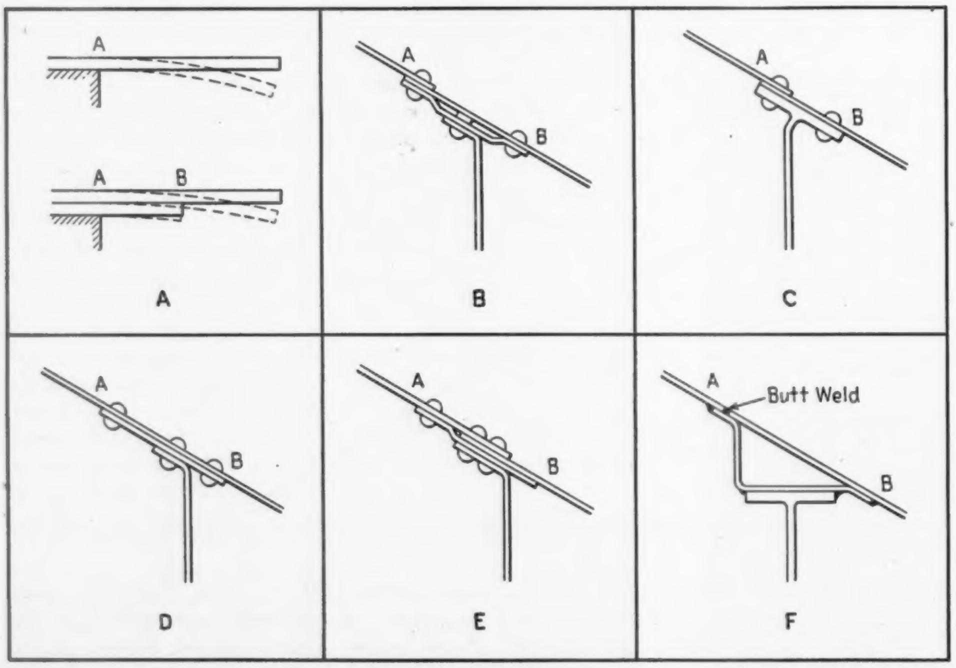


Fig. 10—Floor to bolster connections

at the supporting edge, *A*. In the lower sketch an intermediate plate is introduced which participates in the bending at the support and acts as a cushion to the top plate, as well as serving to distribute the bending effect over a greater distance. This construction is often followed where it is desired to reduce the stress concentration at points of rigid support.

Some examples of the construction around the top flanges of body bolsters may be examined in the light of the foregoing discussion. These are depicted in Figs. 10-B to 10-F. The floor sheet in Sketch B has an intermediate support at edge *B* and also at edge *A*, but at the latter location the lower floor sheet is in the joint and adds extra stiffness or rigidity. Hence the condition at A should be less satisfactory from the standpoint of concentration of flexure in the upper floor sheet at the edge of the supporting member. Sketch C shows a rather common type of beam bolster with the top flange bent to the 30-deg. slope of the floor. At both edges *A* and *B*

the bending of the sheets. The evidence is ample to connect the combination of these two factors to the concentration of premature corrosion failures at the edges of rigid supports.

The lower edge of the hopper sheet over the door angle is often a point of early failure. A combination of the heaviest load and the greatest amount of erosion occurs here. Fig. 11-A shows the details of the construction to be found in most cars. Failure usually occurs at edge *A* where the leg of the door angle normal to the floor sheet furnishes a stiff support for the sheet. An endeavor to meet this condition was made in the Carnegie-Illinois experimental car and is depicted in Fig. 11-B. A reinforcing plate, 12 inches wide, was added to distribute the flexure away from the edge *A*. Of course the erosive action during unloading will inevitably reduce the thickness of the floor sheet and when failure occurs the reinforcing plate is in position to support the lading. In effect, the ultimate patching operation was performed in

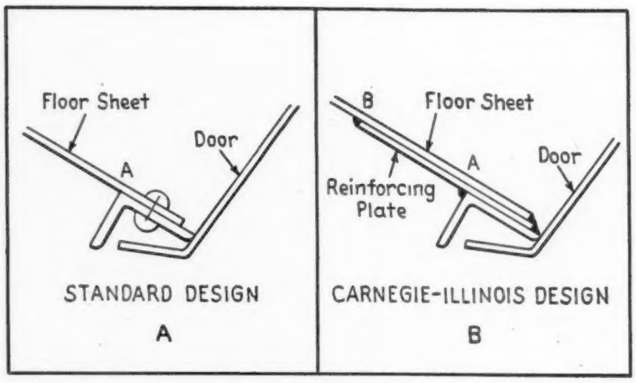


Fig. 11—Detail at door frame

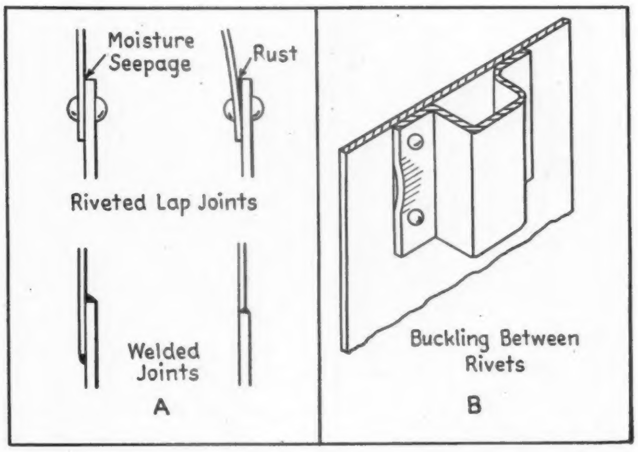


Fig. 11—Detail at door frame

advance and the beneficial support from the plate was obtained from the outset.

The lower flange of the door itself serves to catch coal leachings when they run over the lip and along the bottom surface before dropping to the ground. Thus the flange can be attacked on both surfaces—a condition that is not good from the standpoint of corrosion.

The design of joints should not be overlooked as a factor having a bearing on corrosion. The riveted lap joint of Fig. 12-A has an inherent possibility of moisture seepage between the faying surfaces. Rusting is likely to follow and often the corrosion product, since it occupies a much greater volume than the original steel, will force the surfaces apart. This is particularly true of thin material and actually happened in some side stakes (Fig. 12-B). The flanges were buckled between rivets—which be it said, were spaced further apart than the thickness of material warranted. Corrosion did excessive damage, resulting in the replacement of the stakes at the time of the first major repair.

Specifications generally contain limitations on the spacing of rivets in compression members to assure the strength against buckling and to obtain a tight joint.

It is well to remember that the expansion of rivets during driving sets up compressive stresses in the surrounding materials which can cause wrinkling or buckling between rivets. In an early application of high-strength steel side sheets to box cars a lesser thickness than the usual 0.10 in. in copper steel was used. Smaller rivets on closer spacing were thought desirable for a watertight joint. A trial indicated, however, that the usual size of rivet and spacing were better.

Welding Offers Design Opportunities

Welding has presented engineers with a broad field in which to devise and develop new designs and to make a fresh and often novel approach to old procedures. In its relation to corrosion, welding has opened new possibilities for sealing joints against moisture, as is readily apparent from the sketch in Fig. 12-A. It has offered opportunities for eliminating lap joints in favor of butt joints. A study of the sketches in Fig. 4 will quite clearly reveal the part played by welding in achieving conditions effective in reducing corrosion damage. Fig. 10-F illustrates the use of a butt weld to eliminate the usual lap joint in the floor. A similar joint is used in the C. & O. cars.

The discussion, so far, has centered around the hopper car because the writer believes that most of the corrosion problems are typified in this car. Corrosion in all cases is basically the same process and only the environment varies. The presence of moisture, certain chemicals or mechanical action will produce similar effects in any type of car.

Box and refrigerator cars have special conditions arising from condensation of moisture, which collects in low spots and pockets. Obviously, effort should be made to eliminate such places, wherever possible. A good example of changes for the better is evident in the progressive development of details in the region of the side sill. Figs. 13-A and B show two stages in evolution.

Sketch A illustrates the construction that was quite common practice 20-25 years ago. Condensed moisture, running down the inside surface of the side sheet could find its way rather easily between the grain strip and floor plank and the steel sheet, where it would be retained for a considerable period. This is not favorable condition with respect to corrosion. A later A.A.R. design, which is still standard, shown in Sketch B, used a 6 in. x 3-1/2 in. x 5/16 in. angle with the long leg vertical, thus removing the thin steel side sheet from the region where moisture collects. It is true that there is a small ledge formed by the top toe of the angle, but this point is exposed to the air so that the moisture that does collect can more readily evaporate than in the case where it is trapped between surfaces. However, this small ledge is a good place to apply some protective compound to reduce the possibility of corrosion.

Fig. 13-C is illustrative of the construction proposed for a design in high-strength steel. In view of the above discussion it would seem as though the conditions with respect to corrosion are more like those in Sketch A and therefore less favorable for retarding corrosion.

In a lot of 97 box cars the lower corners of the end side sheets began to corrode through after about ten years and have had to be patched. The repair has been made on many of the cars and as any of the remainder return to the home line the same condition is found to exist. Otherwise, the side sheets are in good condition. A flanged gusset between the side sills and the end posts of these cars was found to be contributing cause. The gusset and side sheet were in close proximity and the space between them served to collect dirt and moisture.

Special Causes of Corrosion

Refrigerator cars are a special case since salt brine is almost always present. Drippings are a serious problem

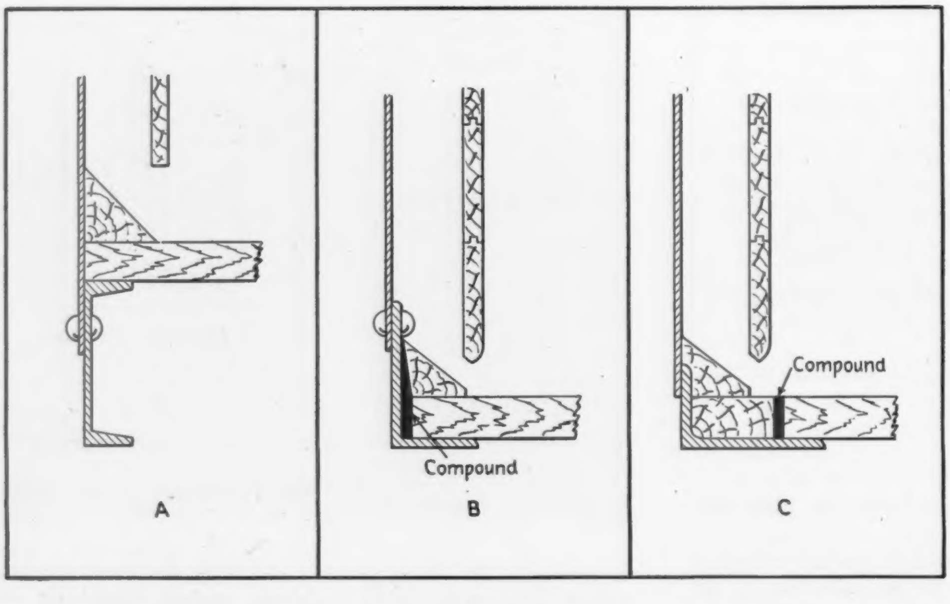


Fig. 13 — Construction at side sill of box cars

not alone to the underframe of the cars but to the track and bridge structures. The A.A.R. is giving much study to this whole matter.

Galvanizing of all steel in contact with ice and salt brine is the common method for protection against corrosion. It is essential to prevent access of brine to those parts of the steel structure which are not protected by galvanizing. The writer knows of a case where brine from overhead bunkers splashed over the edges and ran down the side sheets, causing serious damage to the sheets and side posts.

Gondolas and flat cars with wood floors are subject to corrosion where the wood rests on the steel and retains moisture in the joint. During the repairs to a lot of gondolas it was noted that the center sill covers were badly corroded along the center line. This rather singular occurrence led the writer to investigate the buckling resistance of this cover plate in compression. Because the ratio of its unsupported width to thickness was large it had a small margin against buckling. It seemed quite probable that buckling took place along the central portion of the plate, loosening the rust film, exposing the underlying steel to fresh attach and eventually leading to the failure that took place. Here was a case where design could help to correct a difficulty arising from corrosion.

Passenger and dining cars have contributed a generous share of corrosion problems. Great quantities of moisture must be handled in these cars and ventilation disposes of most of it. However, it is difficult to deal with the condensation on cold sheets and the penetration of moisture into cracks and crevices. No detail of construction is too insignificant to warrant a study of its corrosion potentialities.

The possibility of corrosive leachings from insulation should not be overlooked. In one instance, a hair insulation had been fireproofed with magnesium chloride which caused very serious corrosion of stainless steel and would have produced an even more severe attack on plain steel.

Car washing compounds containing acids, such as oxalic acid, can be troublesome, particularly if the joints are not tight. Vibration and working of a structure increase the difficulty of maintaining tight joints, but it is the function of design to endeavor to prevent the access of moisture to the interior parts of a structure. A case in point is a corrosion attack that occured in the sheets adjacent to the curved corners of some windows. The flexibility of the sheet at these points appeared to be the most likely cause and it is possible that a small stiffening element across the corners would have prevented the trouble.

The widespread use of various metals in passenger cars places the designing engineer under the necessity of giving attention to the possible contact of two metals that may cause galvanic corrosion if moisture is present. For example, contact between stainless steel and plain steel may cause an accelerated corrosion of the plain steel.

The construction details of passenger cars are so varied that no attempt has been made to deal with them specifically. Either the elimination of pockets where moisture can be retained or added protection are two general principles to be followed in reducing corrosion.

Some of the high-strength, low-alloy steels on the market today are much more resistant to corrosion than structural carbon steel. With such steels available, the remedies for exessive corrosion have not been exhausted by the designer who has given consideration only to the methods so far discussed.

Reference again to Fig. 1 will afford a comparison over a period of 11 years among these steels when exposed in an industrial atmosphere. *L* is a structural steel with low residual copper content, *K* is a structural copper steel and the remainder are high-strength steels. It should be noted that not all high-srength steels possess outstanding corrosion resistance, although most of them are as good as, if not superior to, copper steel.

At the end of the test period the relative rates of resistance to corrosion, with steel *L* as the base, were *L*: *K*: *A* as 1.0: 2.5: 6.3. It is commonly stated that the atmospheric corrosion resistance ratios of these three steels are as follows: Carbon steel=1.0; copper steel= 2.0; high-strength steel (Most corrosion resistant composition) =4-6.

The actual service experience will naturally vary consederably from the above ratios, depending upon the environment and conditions of operation. The charts of Fig. 3-A and Fig. 8 afford a direct comparison in hopper car service between copper steel and a corrosion resistant high-strength steel. These curves are an integration of all the factors affecting the life of side and floor sheets.

Long experience with copper steel indicates that its life

(*Continued on page 60*)

How loose wheels are received at the shop and unloaded by monocrane

Milwaukee Modernizes Its Wheel Shop

Excellent results secured with modern monorail system, revised shop layout and only a few new machine tools

THE new car-wheel shop of the Chicago, Milwaukee, St. Paul & Pacific at Milwaukee, Wis., has now been in service more than two years and has demonstrated economy in the handling of parts, flexibility in operation and the capacity to turn out quality work in quantities adequate for most system requirements. In fact, the only other wheel shop on the railroad is that at Tacoma, Wash., where wheel and axle work for lines west is performed.

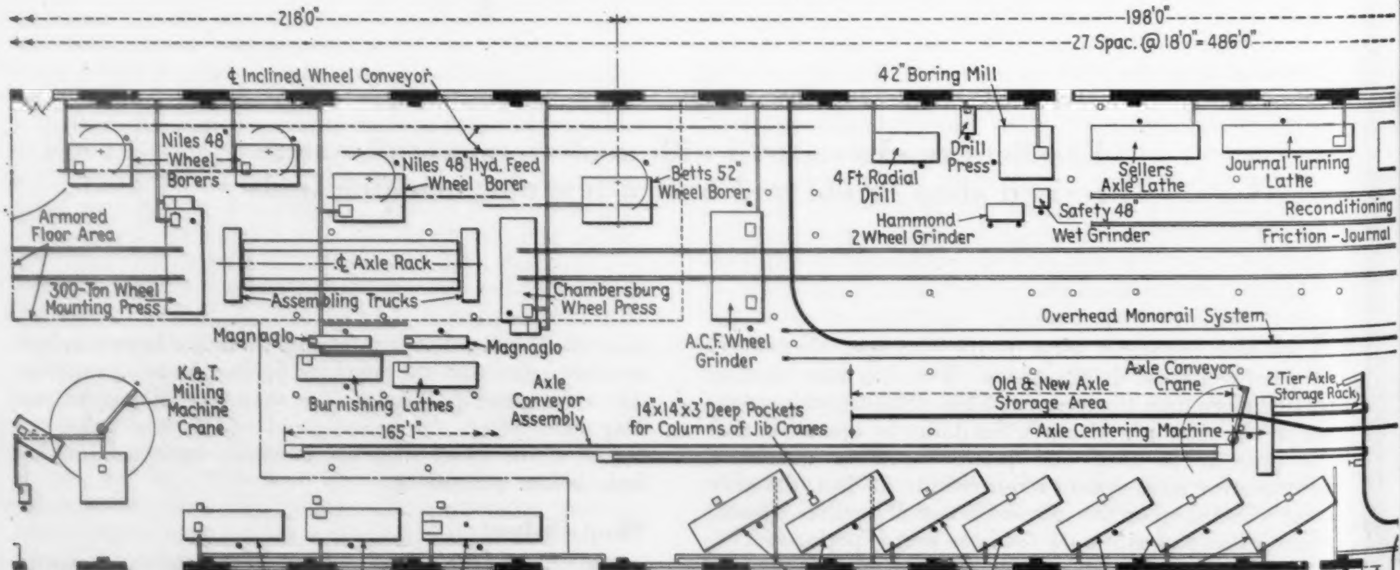
In operating the new wheel shop, primary attention is paid to the quality of workmanship which meets all A. A. R. requirements. A full assortment of master wheel gages is available for periodic checking of all shop gages, and all machines are inspected at specified regular intervals. Axle lathes and wheel boring machines are equipped with standard micrometers and dial micrometers. All wheel-mount recording gages are checked weekly. The Magnaglo machine is checked once each shift with a test axle having a minute known defect to make sure that the machine is functioning properly. All axles passing through the shop are Magnaflux or Magnaglo tested. All second-hand wheels and axles received at the wheel shop are carefully inspected for defects before processing.

Shop Output

The output of the shop under present conditions, working a five-day week and about $1\frac{1}{3}$ shifts in 24 hr., is such that three cars a day are shipped in and out, each car being designed for the double-deck loading of 48 pairs of mounted wheels. The Milwaukee has about 100 of these wheel cars on the system.

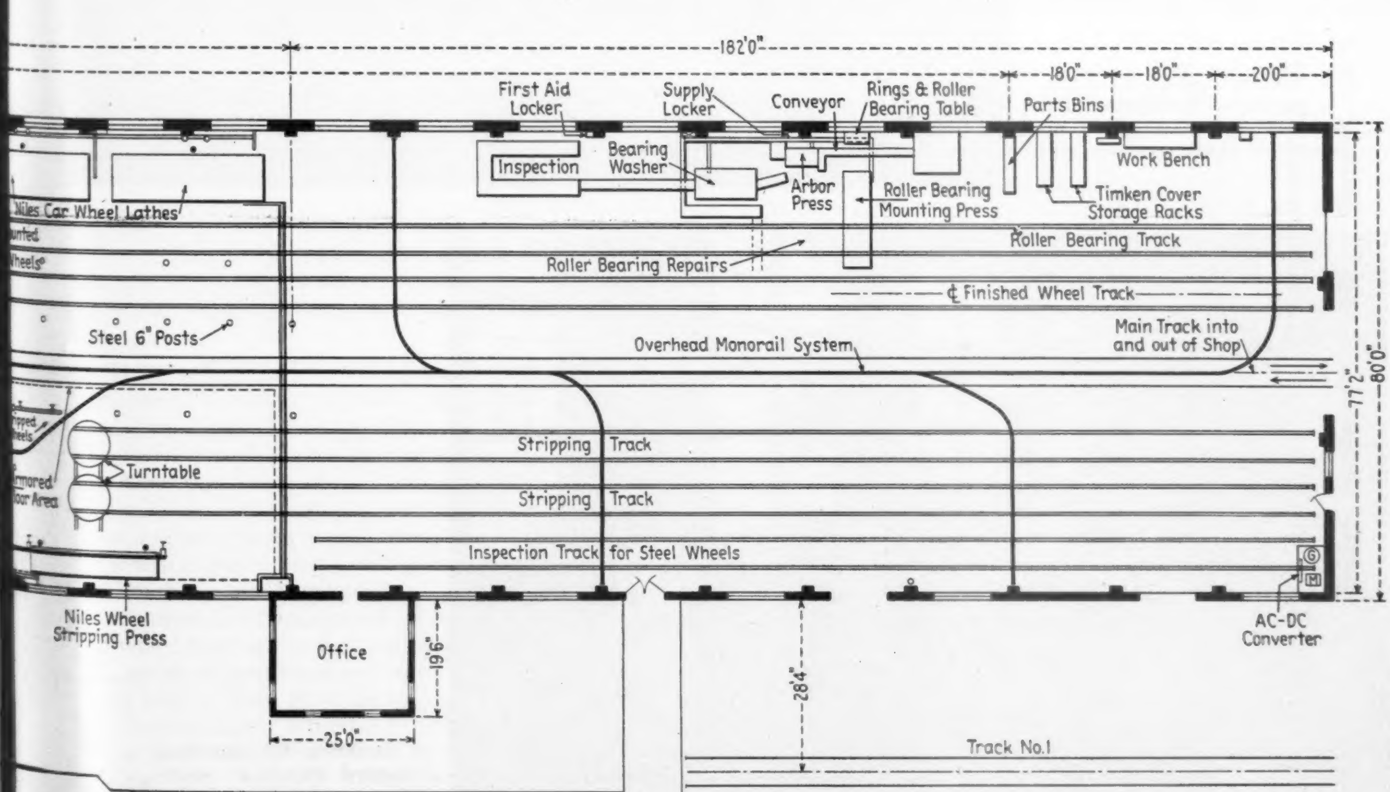
The center unloading and delivery track at the east end of the new shop will hold seven cars but is seldom used for over six, which is more than enough to permit

Double-rail turntable at the Niles stripping press which turns easily on roller bearings

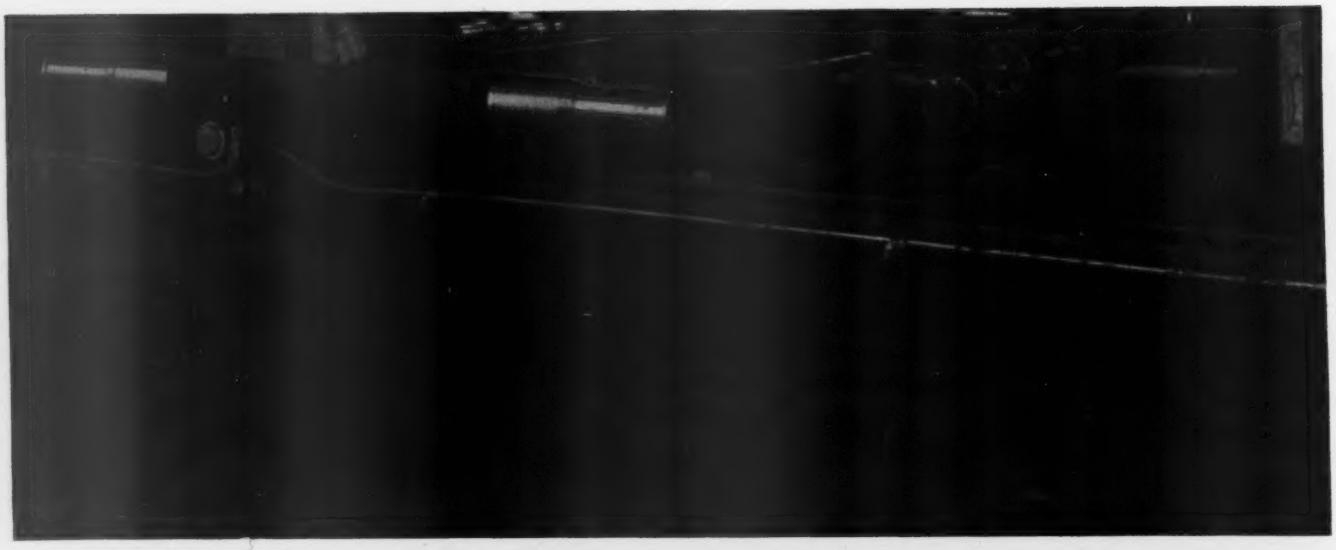


Layout of machinery and equipment in the new car wheel shop of

Battery of seven axle lathes served by axle-feed conveyor



the Chicago, Milwaukee, St. Paul & Pacific at Milwaukee, Wis.



▲ The axle-feed conveyor and one of the electric-eye controls

Wheels moving to A.C.F. grinder — Monocrane has just delivered wheel to wheel chute on shop wall ➤

◄ Facilities for handling mounted wheels at wheel lathes

handling the full production of wheels and axles in and out of the shop each day with a single switching movement. It is estimated that, with a full force and two or three shifts as required on some individual machines or operations, a shop production in excess of 300 pairs of mounted wheels a day can be turned out, including truing the journals on about 80 pairs of mounted second-hand wheels.

This is approximately double the production formerly secured with the same number of men. It is attained while meeting even more exacting requirements of A.A.R. than formerly; also in spite of the fact that only about 70 per cent of the wheels now handled are cast iron, as compared with 90 per cent formerly.The increased percentage of steel wheels handled requires substantially more time for machining.

Improved Material Flow

Most of the improvement in output at the new Milwaukee car-wheel shop is credited to rearrangement of machinery and equipment, installation of the monorail system, gravity wheel chutes and other devices to expedite the handling of wheels and axles, either mounted or unmounted, and thus save both time and labor.

The only new machines, purchased in 1948 and installed in the Milwaukee car wheel shop, included two Sellers axle lathes, a Niles 48-in. hydraulic-feed wheel borer and one Chambersburg 300-ton wheel mounting press. All other machinery was transferred from the former car wheel shop at Milwaukee and included a number of axle lathes and wheel borers, built prior to 1936 but kept up to the mark as regards accuracy through constant checking and adjustment by experienced operators and the shop machine maintenance crew.

The shop is also equipped with an A.C.F. car-wheel grinder purchased in 1942, and a roller-bearing washing machine purchased in 1941. These individual machines are of such importance to the shop output that their installation was a practical necessity, beyond the scope of a return on the investment.

Shop Layout

The layout and equipment of car wheel shop are clearly shown in the drawing. The building available for this work had too low headroom for an overhead crane so it was decided to feed the material to the lathes, mounting presses, burnishing machines, etc. by the use of an overhead monorail system and wheel and axle conveyors. The building itself is an old structure built originally in 1906 and portions of it rebuilt after a fire in 1931.

The overhead monorail system is an American Engineering Company product, supported from I-beams and steel pipes. There are three one-man operated, 2-ton Monocrane trolleys on the monorail system, one being an American Lowhead and the other two being Shepard-Niles. One of the latter is used as a spare. The two inclined wheel conveyors, or wheel chutes were constructed in the Milwaukee Shops and each feeds two wheel borers, as shown in the drawing.

Mounted friction-journal wheels for processing enter on wheel flat cars at the east door and are spotted under the overhead monorail, unloaded and placed on the stripping tracks. Here they are inspected and then rolled up to the turntables, turned and rolled into the Niles stripping press located as shown in the drawing.

Cast iron stripped wheels are rolled into the area marked "stripped wheels" where they are picked up by the overhead Monocrane and loaded on flat cars for delivery to the foundry. Scrap steel wheels are handled in the same manner for scrap sale. Steel wheels for remounting are handled by monocrane directly to the wheel conveyors for reboring.

Axles are handled on the small monorail system and placed on a two-tier gravity-roll axle-storage rack. Axles move into position at the centering machine where they are handled by a 1-ton hoist suspended on a rotary boom to the centering operation. Here they are wire-brush cleaned on the center portion between the wheel seats, according to A.A.R. recommended practice prior to Magnaglo axle inspection. The hoist also is used to load the axle-feed conveyor to the seven axle lathes. The gravity-roll axle rack is located so that the first axle lathe in line has access to any axle on the rack. This gives flexibility to the layout and allows for any emergency outside the general shop production run and will not interfere with the continuity of the shop operation.

The axle conveyors are designed with manually-operated electric lock stops at each lathe and are equipped with electric eyes at the end of the conveyors.

After the axles are turned in the axle lathes they are placed on the second conveyor and conveyed to the axle burnishing, axle Magnaglo and Magnaflux machines by monorail for inspection and to the axle rack directly in front of the wheel mounting presses, at which point wheels are applied to the axles and the assembly rolled into the wheel press for mounting. The axle conveyor is stopped when the axle has reached the end of the conveyor by an electric eye.

Mounted wheels are rolled through the mounting press directly to the wheel grinder where the treads are ground; from there to the loading tracks for loading on the wheel cars by the overhead monorail.

Carloads of friction journal wheels for tread turning are handled by means of the overhead monorail system to the two wheel lathes for turning. After turning the wheels are continued on the storage track ahead of the wheel lathes to the journal lathes for journal truing. From the journal-turning lathe they are magnafluxed on the shipping track and then reloaded.

Roller-bearing wheels entering the shop for processing are unloaded from the cars by means of the monorail system to the roller bearing mounting and stripping press track where the roller bearings and housings are stripped from the axle by means of a rebuilt wheel mounting press, as illustrated. At this point the bearings and housing assemblies are disassembled by means of an arbor press and propelled by gravity conveyor through the washer to the inspection center.

The wheels for turning continue on the roller-bearing stripping track to the wheel lathes where they are picked up by the overhead 4-ton electric hoist and placed in the wheel lathe for turning. Wheels suitable for passenger service are placed on the adjacent track to be conveyed back to the roller-bearing mounting press where the bearings and housings after inspection and reassembly are pressed back on to the axle.

Wheels unsuitable for passenger service but suitable for freight are transferred at this point by means of the monorail back to the stripping track and there stripped for reapplication to freight axles. Wheels found not suitable for passenger service are turned while on the roller-bearing axle to facilitate later reboring of the wheels for application to freight service.

The roller-bearing axle is stock piled immediately adjacent to the stripping press until a sufficient number

Details of wheel chute delivery to one of the boring mills

How mounted wheels are loaded on special flat cars for movement out of the shop. Each double-deck load includes 48 pairs

have been accumulated to warrant a run of wheels through the boring mills. Roller-bearing axles are processed in the same manner as the friction axles as far as handling is concerned except they are not put through the burnishing machine.

Roller-bearing wheels after mounting are processed through the grinder, the same as plain bearing wheels, and then transferred to the roller-bearing track by means of the overhead monorail where the roller bearings are reapplied the same as before.

All mounted wheels for shipment are loaded by means of overhead monorail on special wheel flats, all under the roof of the wheel shop.

Loose wheels coming into the shop are loaded on flat cars provided for that purpose, or in gondola cars coming from the various manufacturers. Both cast and steel wheels are unloaded from the car by means of overhead monorail used in connection with self-tripping tongs, and loaded into a gravity feed wheel conveyor to the various boring mills. Wheels are unloaded from the wheel conveyor to the boring mill by means of a gate that is tripped allowing the wheel to fall from the wheel conveyor to the post where it is lifted into the wheel borer by the usual wheel borer hoist. Wheels are rolled from the boring mills to the mounting press.

Outside facilities at this car wheel shop consist of track storage facilities capable of holding 2,000 pair of mounted wheels, plus adequate space for storage of loose wheels and axles.

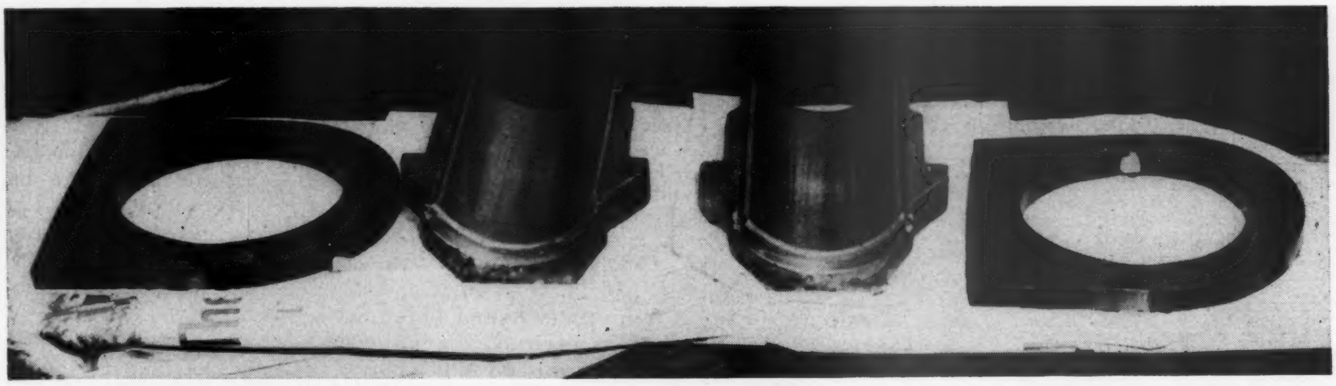


Fig. 1—Conditions of the bearings and axle stops at locations 11 and 12 in August, 1950, after 175,984 miles of revenue service

I. C. Tests Device To Reduce Hot Boxes

Results indicate that device to limit horizontal motion of axle can reduce hot boxes and other bearing damage

A DEVICE designed to prevent hot boxes and other damage to journal brasses from one major cause has been on test on the Illinois Central for the past two years. The device is known as the Axle Stop, and is a product of Axle-Stop, Incorporated, Chicago.

The purpose of the Axle Stop is to reduce the horizontal motion of the axle from impact or brake action, the latter particularly on cars with single-shoe brakes. In so doing the stop limits the cocking and lifting of the brass off the journal, and thereby lessens the possibilities of a hot box; the strands of waste do not have the opportunity to wedge between the journal and the brass.

The Axle Stop accomplishes this objective by reducing the clearance between the opening in the back of the journal box and the dust guard seat of the wheel. The stop is shaped like the conventional wooden dust guard, but is made of oil-resistant Neoprene rubber with steel inserts on opposite sides of the journal. It fits snugly in the dust guard well, and with a 1/8-in. clearance around the dust guard seat. The horizontal movement of the axle is thus restricted to the 1/8 in. before the dust guard seat of the wheel comes in contact with the steel insert.

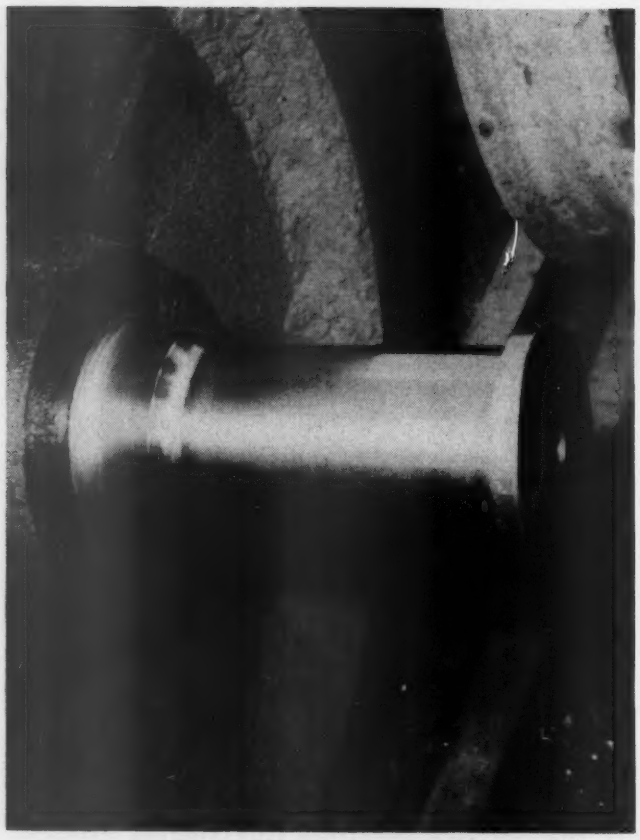
The test was conducted by equipping one of two cars in comparable service with the axles stops. The car so equipped was I.C. Cafe-Lounge 4005, which has six-wheel, three-beam trucks with single-shoe brakes and 5 in. by 9 in. journals. All journals were between 4-15/16 and 5 in. in diameter with dust guard seats from 6 1/16 in. to 6 1/8 in. in diameter. The holes in the axle stops were 6 3/8 in. in diameter. The width of the stops was 8 3/4 in., the width of the dust guard wells 8 7/8 in.

Car 4005 was equipped all around with Axle Stops at the I. C. Burnside Shops on March 29, 1949. In September of that year all brasses and wedges were removed, cleaned and examined, and the boxes cleaned and repacked. At the second repack period, February, 1950, Brass No. 5 had a broken collar, and a new brass was applied at this location. Other brasses were reapplied. In this and the preceding inspection all brasses were marked to indicate the number of repack periods.

On August 24-25, wheels Nos. 11 and 12 were removed and new wheels applied. All journal boxes and parts were cleaned and carefully examined. Both brasses showed 1/32 in. outer end wear and 1/32 in. wear at fillet end. Linings showed no indication of distortion. Contacts were 3 1/4 to 3 3/4 in. wide through center of bearing 11, and 3 1/2 to 3 7/8 in. wide on No. 12. Axle Stops showed no wear; the hole was 6 3/8 in. both horizontally and vertically. The steel insert was not battered, wedges were OK.

Fig. 1 shows bearings and dust guards at locations Nos. 11 and 12. Fig. 2 shows dust guard seat of journal No. 11. New brasses and new wheels were applied at locations 11 and 12, the original brasses having made approximately 175,984 miles. The same dust guards were reapplied in original locations. There was no indication on the brasses removed of having contacted the side stops of journal boxes, or of contacting the inside dust guard well walls. Dust guard seats on the axle appeared to have slight built up metal from the steel inserts but were not scored.

Wheels Nos. 9 and 10 were also removed and all parts cleaned and examined after same mileage. Both brasses showed 1/8 in. wear on outer ends. Some lining squeezed



▲ Fig. 2—The dust guard seats in August, 1950, had a slight build-up of metal but were not scored

out on fillet end. Linings were not run and no contact had been made with side stops in the box. Dust guards showed contact having been made on one side only—that in the direction of brake thrust. The No. 9 stop showed 1/64 in. of rolled metal over an edge of steel insert, and showed contact had been made in two adjacent locations (Fig. 3). Dust guard seats on axle were in slightly better condition than those in locations Nos. 11-12.

Wheels Nos. 7 and 8 were removed and all parts cleaned and examined. Brass No. 7 showed journal contact 2½ in. wide outer end and 3¼ in. wide on inner end, on center line of brass. Brass No. 8 showed contact 2½ in. outer end, 3½ in. inner end, on center line of brass. There was no indication of brasses contacting side stops and no run linings; no end wear on outer end of either brass and only a mark on inner or fillet ends. New brasses were applied and those removed held for further inspection. These brasses had been applied on March 8, 1950, when wheels Nos. 7 and 8 were changed, and had run approximately 58,968 miles.

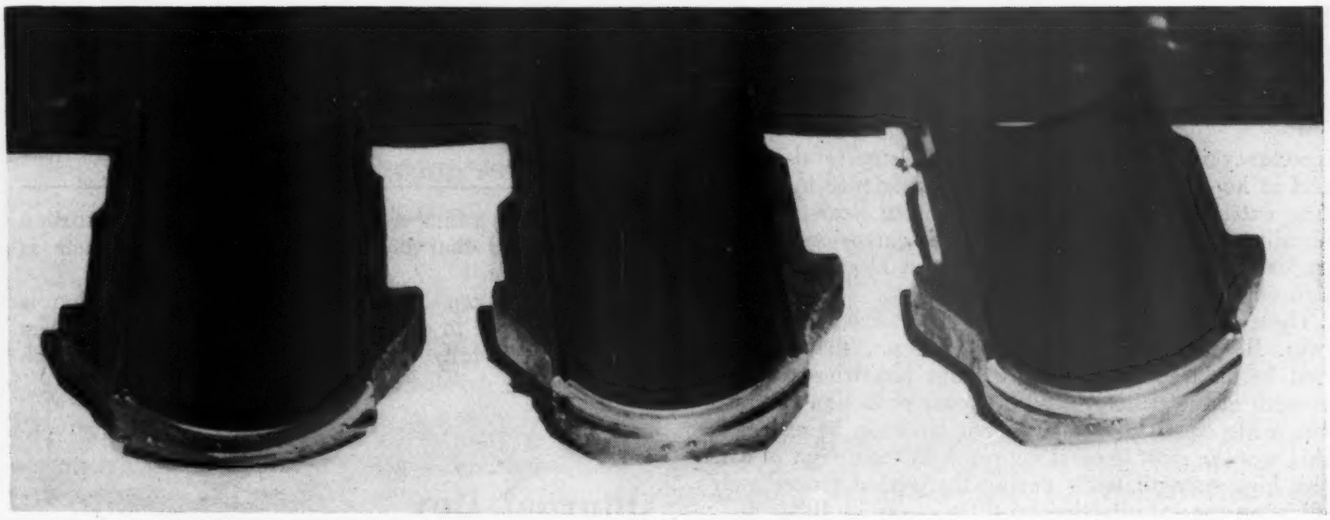
Boxes Nos. 1, 2, 3, 4, 5 and 6 did not have wheels dropped but brasses and wedges were removed, and all parts thoroughly cleaned and examined. No visible wear was noted on any of the axle stops in these boxes, observed from the outside. Brass No. 1, originally applied March 29, 1949, was renewed on account of some lining metal being squeezed out at fillet end—contact 3¼ in. wide, full length, on center line of brass. No contact of brass with side stops in box.

Brass No. 2 was removed account lining bearing metal squeezed out at fillet end. End wear was 1/32 in. on outer end; small piece of lining metal broken out, outer end, right side; no contact with side stops in box. Good contact—3¼ to 3½ in. wide through center of brass. Wedge OK. New brass applied.

Brasses and wedges, Nos. 3 to 6 were satisfactory and were reapplied.

The comparison car, I. C. Baggage Car 633, had the same type of trucks but without axle stops. Fig. 5 was

▼ Fig. 3—Axle Stop 9 in August, 1950, is shown on the right; No. 10, on the left



▲ Fig. 4—Brasses 11, 7 and 9 (from left to right), removed on account of changing wheels, typified the absence of double bearing seats and bruising on the sides of bearing from contacting the lugs in the journal box

▼Fig. 5—Three brasses removed from Car 633, not equipped with axle stops, showing double bearing seats and bruising from contacting the journal-box lug

taken of three of the bearings removed from the 633 at repack on August 24, 1950. There were a total of five brasses removed from Car 633; the two not shown in Fig. 5 were removed for other causes. Each of the brasses in Fig. 5 showed lining squeezed out due to impact and brake thrust, and showed distinctly the double bearing on the surface of lining metal due to car movement, while journals were held out of center under brasses.

On March 13, 1951, after 312,000 miles with the axle stops, Car 4005 had wheels changed at box locations Nos. 3, 4, 5 and 6. The other boxes had the journal box packing removed and brasses examined for periodical repacking of journal boxes per A.A.R. Rule 66.

The dust guard seat of journal at box No. 3 location was smooth and in good condition. Dust guard seat on the journal at box No. 4 had slight scratches. The dust guard seats on the journals at boxes Nos. 5 and 6 had a very slight build up of metal which apparently was picked up from the inserts in the axle stops.

Journal bearings were removed at boxes Nos. 3, 4, 5 and 6 on account of the wheel changes and none were condemnable as to end wear, etc. All of these bearings except No. 5 had been in service since the test was started. No bearing had reached a full seat, indicating that the axle stops had kept the bearing centered on the axle.

Journal bearing No. 2 was removed due to the collar broken off back; otherwise this bearing was in good condition. Journal bearing No. 7 was removed due to collar end wear, but had a perfect seat on the journal and no indication of the lining being damaged on either side of the bearing. Journal bearings Nos. 9 and 11 were removed on account of fillet end wear.

Journal bearing No. 12 was removed through error. Since the car had already been returned to service the bearing was not put back after the error was detected. It was applied August 24, 1950, when wheels were applied at this location.

All of the journal bearings were tested by ringing with a hammer and all found to have the linings tight. The babbitt lining of all the bearings removed showed no indentations or marks indicating any wear on the side of the back or damage to the babbitt lining.

The axle stops in boxes Nos. 3, 4, 5 and 6 where wheels were changed were examined closely and found to be in good condition, with no noticeable change since last inspection. Visual inspection was made of the other Axle Stops, and from all appearances they were in good condition with no apparent change from the last inspection,

Rust—How to Combat It

(*Continued from page 50*)

expectancy is about $1\frac{1}{2}$ times that of structural carbon steel in hopper car service. Service experience in hopper cars, extending over the past seventeen years, is now affording evidence that the more corrosion-resistant grades of high-strength steels last about $1\frac{1}{2}$ times longer than copper steel.

These high-strength steels can be utilized in several ways. Because of their greater strength, they can be used in reduced thicknesses without impairment of the strength of the structure. With proper reduction in thickness a life equal to that of copper steel can be expected. This was the most general approach to the design of cars with high-strength steels during the period immediately following the introduction of these steels in 1934.

On page 109 of the Carbuilders' Cyclopedia of 1937 there was a brief statement on trends in car construction which read as follows: "At the present time there is a marked tendency toward decreased freight car weights obtained by the use of alloy high-tensile steels and by refinements in designs, not only in the car itself but also in detail parts."

Weight savings up to $3\frac{1}{2}$ and even 5 tons per car were obtained with the high-strength steels, making available a corresponding increase in pay load capacity. The extra cost of material was largely offset by the reduction in weight of steel required, so that the first cost of a car was nearly equalized.

In recent years the trend in the use of high-strength steels has been quite definitely toward their utilization in the same and even greater thicknesses than have been common practice with copper steel.

The cost of major repairs has risen so high that it has become of vital importance to extend the time between shoppings. It is here that the corrosion-resistant high-strength steels can make a substantial contribution by providing extra life, the extension depending upon the thickness used.

A recent study of the extra cost f.o.b. mill, of the side, end and floor sheets of A.A.R. standard hopper cars in contact with the lading gave the comparison between copper steel and USS Cor-Ten in the same thicknesses shown in Table I.

With the time between major repairs increased 50 per cent with high-strength steel, it is evident that there will be two renewals in copper steel for one in high-strength steel. Taking the items of cost for a 70-ton car and including the original steel, the copper steel would cost 3 x \$502.50=\$1507.50 and the total for USS Cor-Ten would come to 2 x \$708.55=\$1417.10. There is a saving of \$90 in the cost of material in addition to a saving in the fabricating cost of one major repair (usually about 500-850).

The aim of this discussion has not been to propose specific designs, but rather to suggest a method of approach to corrosion problems through a knowledge of how corrosion occurs in different environments. One can always learn much from examining structures with a critical eye and mind to determine, if possible, the underlying causes of whatever corrosion is found.

Corrosion protection costs money, but neglect to take it into account will often prove more costly still. When first cost is made the deciding factor, there is no assurance that, in the long run, the total cost will be a minimum. So long a time elapses before the costs of corrosion are developed that the temptation to procrastinate is always present.

Table I—Comparative Costs of Hopper Car Sheets in Contact with Lading

	Cost of Material		Extra cost
Capacity of car	Copper steel*	U.S.S. Cor-Ten*	of U.S.S. Cor-Ten
50 ton	\$393.31	\$554.59	\$161.28
70 ton	502.50	708.55	206.05

*Same thicknesses in both steels

This much can be said in conclusion. Corrosion is still a challenge to everyone concerned with the problem it creates and fully warrants all the study and research that is being devoted to its reduction.

Journal Box Wedge Reclamation

Journal box wedges are reclaimed for about one-eighth the cost of a new wedge by re-forging the 78-in. radius across the top. The operation is performed on a 5-in. Ajax horizontal forging machine. The side dies are the shape of the wedge and the stationary die has a 78-in. radius. The moving die is straight with a bulge $3\frac{1}{4}$ in. wide by $2\frac{1}{4}$ in. long and $\frac{1}{16}$ in. deep. This budge applied to the journal side of the wedge reforms the wedge with the 78-in. radius on the top without disturbing the bearing surface.

This operation is currently being performed on wedges for 80,000-lb. cars and for 100,000-lb. cars.

Reclaiming a journal box wedge by re-forging the 78-in. radius across the top

The bulge in the die is the same size for either capacity wedge. The bearings are heated to between 1,550 and 1,600 deg. for the forging operation, which is done at as low a temperature as practicable to reduce the amount of scale formed. After forging the wedges are wire brushed by hand and ground.

Engine Oil Pressure*

The lubrication system is an engine's life line and malfunctioning may lead to serious failure. The significance of oil pressure as an indicator is the basis of this discussion

***P. A. Binda*†**

USING the same unit in the second test, oil temperature was maintained constant at 130 deg. F. and pump speed varied using oils P-3 and N-3S again. The pressure data obtained are shown as Figure 8. These curves show that discharge and line drop pressures increased with increased oil flow. Although the differences in respective pressure values between the two oils are considered to be of little significance, the relationship again showed lower discharge and line drop pressure for the lower viscosity oil at equal flow rates. These results agreed with the equation of flow. Since for any one discharge pressure the oil flow rates were not equal even though the differences in flow rates are of no practical value, it is apparent that the oil pressure gauge reading alone did not indicate the quantity of oil flowing.

From Fig. 9, where pump speed was varied with constant oil temperature and the viscosities of both oils were sufficiently high it is apparent that the system did not recognize oil VI and output was a linear function of speed. However, oil pressure increased with output as discussed in Part I.

From these data it appears that high and low VI oils show little or no pressure difference at temperatures associated with normal engine operation.

*Part II of the abstract of a paper appearing in the Texas Company's technical publication, Lubrication, March, 1951.

†Technical & Research Division, Texas Company

The Reynolds Number was calculated for the maximum flow condition to determine what type of flow was being obtained. A value of 0.04 was obtained which, being less than 0.141, the critical value, indicated that laminar flow was experienced in all cases.

Actual Engine Oil Pressures

These simple tests indicate that normal equations of fluid flow are applicable to an engine lubrication system. Therefore, in an actual engine, oil pressures should be affected by the following factors:

1. Oil pressure should vary with oil viscosity or, since viscosity varies inversely as a function of temperature, oil pressure also should vary inversely as a function of oil temperature.
2. Oil pressure should vary with flow, or since pump output varies with speed, oil pressure should also vary with engine speed.
3. Oil pressure should vary inversely as a function of outlet size (oil passage clearances) in the system or, oil pressure also should vary inversely as a function of wear.

Oil pressure-engine speed relationships were determined in a gasoline engine for one oil at various crankcase temperatures and a constant jacket temperature. The data obtained are shown as Figure 14. It is apparent that in this case oil viscosity based on crankcase temperature

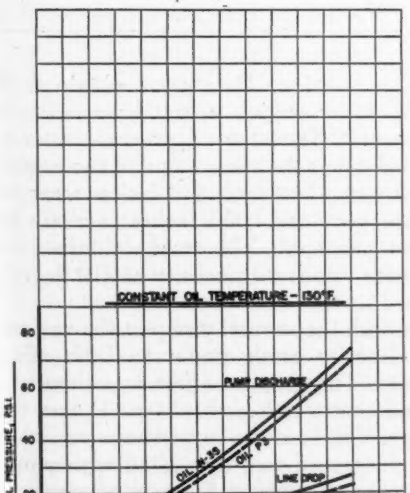


Fig. 8—Oil pressure-flow relationship for a simulated lubrication system

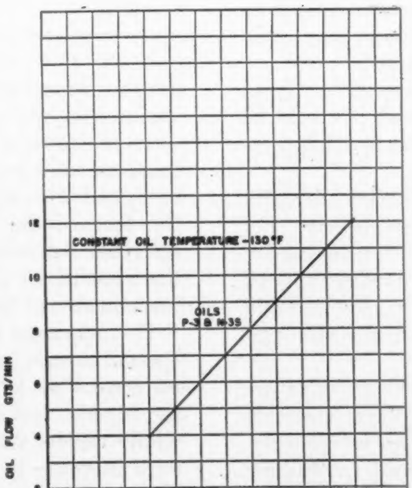


Fig. 9—Oil flow-pump speed relationship for a simulated lubrication system

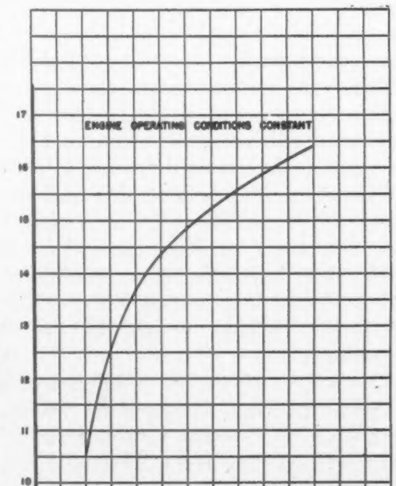


Fig. 10—Oil pressure-viscosity relationship for a gasoline engine

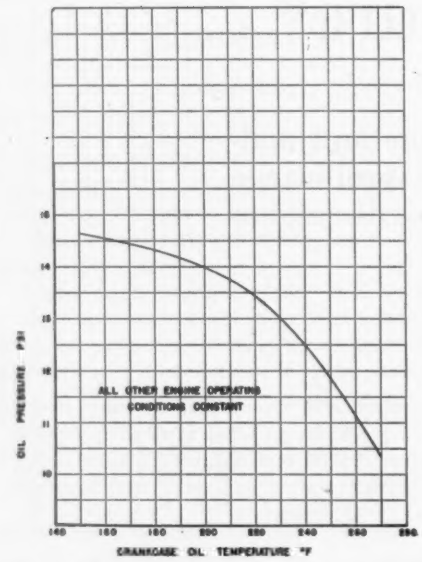


Fig. 11—Oil pressure-temperature relationship for a gasoline engine

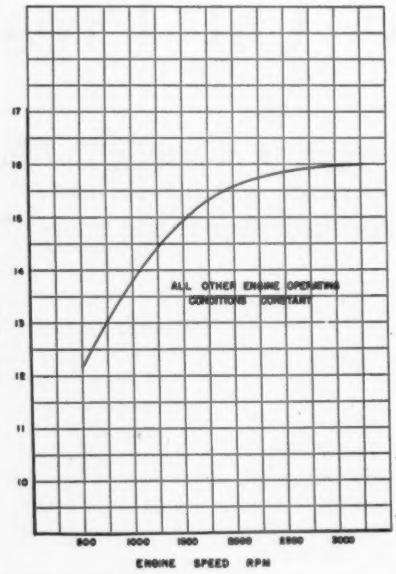


Fig. 12—Oil pressure-engine speed relationship for a gasoline engine

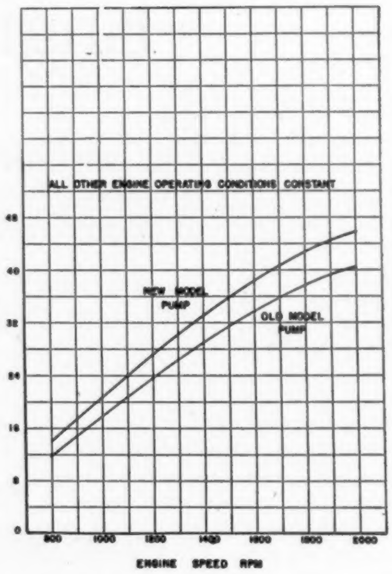


Fig. 13—Oil pressure-engine speed relationship for a Diesel engine

had little or no effect on oil pressure except at idling speeds although the engine speed effect was noted. At first, it would appear that perhaps the data are wrong or the equations of fluid flow do not apply. However, further data were obtained on this engine to better visualize what occurred in the oil system. Oil gallery temperatures were determined throughout the engine speed range at three different jacket temperatures with the crankcase oil temperature maintained as low as was possible (110-120 deg. F.). The oil gallery temperatures are shown as Figure 15. It is quite apparent that jacket temperatures had a marked effect on controlling oil temperature in this engine. Other engines also have their particular characteristics relating jacket and oil temperatures. These data show that the oil temperature is not constant throughout the lubrication system, therefore, oil viscosity also varies throughout the system. The equations of flow are vaild in the engine but become more complex to apply since oil viscosity varies along the flow path.

When oil pressure data such as obtained in a Diesel engine as shown in Table II are encountered it would be unwise to adhere to the existing belief that low oil pressure always indicates defective lubrication.

Operators who believe this and use a higher viscosity grade oil in an effort to increase oil pressure may not overcome their problem as will be shown subsequently.

The data in Table III were obtained at constant speed and load conditions in a railway Diesel engine wherein the jacket coolant is used as the coolant for oil heat exchangers.

The effect of jacket temperature on oil temperature is apparent. Since temperature inversely affects viscosity the engine oil pressure reflected the reduction in viscosity. Although oil flow rates were not determined in this engine the increased pressure drops through the engine with decreased viscosity were associated with increased oil flow. These data show that the effect of jacket temperature on oil pressure is markedly different for different types of engines.

Oil pressures for all of the oils shown in Table I were determined in an automotive gasoline engine that was

TABLE II

Water Temperature, °F.	*Constant Speed Oil Pressure, PSI*
150	50
170	40
190	30

TABLE III

Jacket Temperature, °F.	*Oil-Temperature, °F.*	*Oil Pressure, PSI To Engine*	*Oil Pressure, PSI Drop in Engine*
104	120	61	5
134	156	60	8
141	164	60	13
164	186	57	15
191	214	53	19
200	240	50	23

in good mechanical condition. Data were obtained at various speeds while other engine operating conditions were maintained constant. Then the oil pressure determinations were repeated using the same oils and the engine equipped with an oil pump that had .010 inches wear on the face of the drive gear and .008 inches increase in backlash between the gear teeth. The results obtained on the basis of oil pressure versus oil viscosity at 210 deg. F. are shown as Figure 16.

It is apparent that with the normal pump at the various speeds shown, oil viscosity grade had very little effect on engine oil pressure. The greatest effect was shown at the highest speed and that was less than 4 p.s.i. over the whole viscosity range. The increase in pressure variation with increase in engine speed was associated with pump characteristics. Also, pressure was a function of viscosity rather than type of base stock or VI.

With the worn pump in the highest speed range (lower of upper pair of curves) a consistent reduction in oil pressure was experienced through all the S.A.E. grades. This is reasonable since the excess capacity of the oil pump maintained the same relative order of pressures

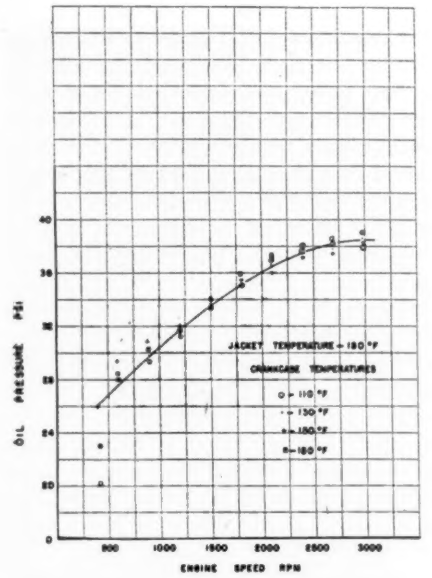


Fig. 14—Oil pressure-engine speed relationship for a gasoline engine

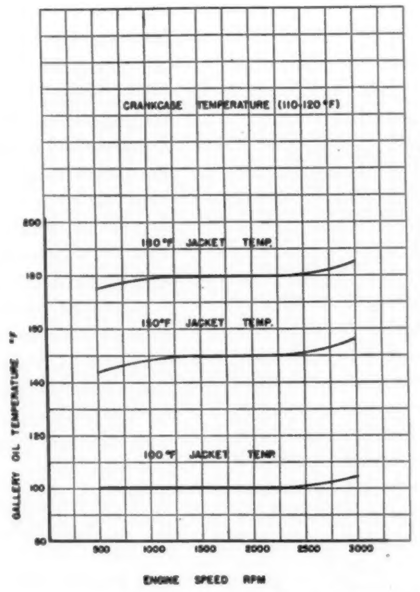


Fig. 15—Effect of jacket temperature on oil temperature in a gasoline engine

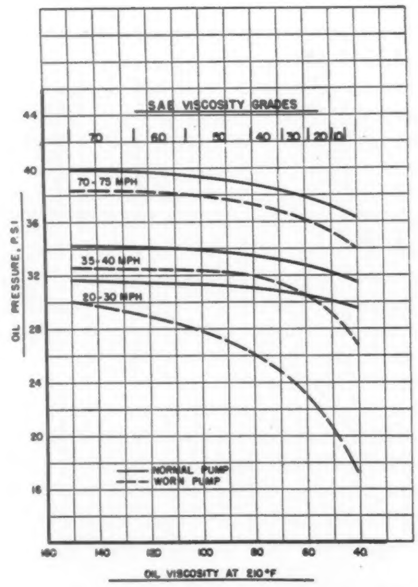


Fig. 16—Oil pressure-viscosity relationship for a gasoline engine

which reflected the slip loss in the pump resulting from the wider clearances. As speed was reduced, using the worn pump, oil pressures were lower and showed a further decrease with decreasing S.A.E. grade. In the lowest speed range shown the possibility of insufficient flow rate for proper lubrication and cooling existed with oils below an S.A.E. 40 grade since the manufacturer specifies a minimum of 25 p.s.i. oil pressure at these speeds.

These results indicate that at normal engine operating temperatures the effect of viscosity on oil pressure is relatively small when the engine and pump are in good mechanical condition. However, if large engine oil pressure changes are experienced with minor viscosity changes, it is an indication that an unsatisfactory mechanical condition exists.

Oil Pressure Related To Flow

That a reduction in oil pressure means an increase in flow in the engine system is usually accepted as fact, however, this is true only under certain conditions. Considering the oil pump, a reduction in outlet pressure increases volumetric efficiency, however, in the range of engine oil pressures normally experienced, this increase of efficiency is small and would increase flow only slightly. Considering the engine, the only factor that affects pressure is viscosity. However, in the normal operating range of crankcase temperatures there are only small changes in viscosity, therefore, also in pressure.

In the case where pressure drop is due to enlarged clearances, such as bearing wear, flow will increase through the enlarged clearances (Equation 3) but the total flow in the system remains the same except for the following condition.

Engine oil pumps are normally designed to have excess capacity to take care of normal engine wear or enlarged clearances. To avoid excessive pressures while the engine is new a by-pass arrangement controlled by oil pressure is incorporated in the system. If either a change in clearance or viscosity occurs that reduces pressure below the pre-determined setting of the by-pass control, the by-pass valve closes diverting more oil to the engine galleries, assuming, of course, that the oil pump has excess capacity. The increased flow tends to restore oil pressure (Equation 1). If conditions arise that increase viscosity, or clearances are reduced, the process will reverse itself. Also, the condition can exist whereby the by-pass line is not sufficiently large to take care of all the excess flow; then the oil pressure gauge will indicate a pressure rise above the control setting which registers the restraint to increased flow (Equation 1).

In a worn engine or with a worn pump such as shown in Fig. 16, it is apparent that at high speeds the pump still had sufficient excess capacity to override the control pressure setting of 30 p.s.i., however, at lower speeds there was insufficient capacity to maintain pressure. The drop in pressure experienced did not mean more oil was flowing. Also, the reduced pressures may not have been a reflection of lower oil viscosity alone but also a reduction in flow (see Fig. 7). In all of these cases it is apparent that the oil pressure gauge did not necessarily indicate the rate of oil flow.

Factors Affecting Viscosity

Oil viscosity in an engine is affected by fuel dilution and heat which reduce viscosity, and by oxidation or contamination with solid or tarry materials which tend to increase viscosity. However, if dilution, oxidation or contaminant products present in engine oil change the viscosity of the oil the equivalent of more than one S.A.E. grade, then either oil change periods are too extended or improper operation or performance of the engine are indicated. From Fig. 16 it may be noted that a change of one S.A.E. grade in the engine with a normal pump resulted in less than a one p.s.i. change in oil pressure which cannot be detected readily on most engine oil pressure indicators.

Increasing viscosity grades in a rotating journal and bearing combination results in an increase of heat generation from oil film shearing with increasing oil viscosity. Accordingly, this increases the temperature of oil returned to the bulk oil to be supplied to the bearing.

TABLE IV

Oil	*P-3C*	*N-4A*	*P-3*	*N-5*
VI	102	63	97	0
Engine Speed, RPM		Oil Pressures, PSI		
1200	32.3	33.3	32.0	32.2
1800	35.4	35.8	34.0	36.0
2400	36.4	37.0	36.5	37.2
3000	38.0	38.8	38.0	39.0

TABLE V

Oil	*Vis. SUS at 210° F.*	*VI*	*Oil Pressure, PSI*
A	68.9	0	47
B	77.0	56	54
C	75.2	61	50
D	79.5	86	51
E	80.0	92	47

Therefore, the net effect is a tendency for the changes in oil temperature to offset the viscosity effect shown in Fig. 16 which was determined at a constant temperature. Of course the inclusion of an oil cooler in the system would alter this condition.

Effect of VI On Engine Oil Pressure

A question is usually raised regarding the effect of VI on oil pressure since a low VI oil decreases in viscosity more rapidly than a higher VI oil as temperature increases. In the discussion above it has been pointed out that viscosity is the controlling factor, therefore, it would seem that differences in VI would have an effect. However, in the temperature ranges associated with normal engine operation the viscosity difference between oils of different VI's in the same grade are relatively small, therefore, there should be very little difference in engine oil pressure. This is substantiated by data obtained in an automotive gasoline engine at constant 180°F. jacket and 190°F. oil temperatures with oils of approximately equivalent 210°F. viscosity but different viscosity index. (Table IV.)

It is apparent that VI had little or no effect on the engine oil pressure under normal operating conditions. Similar data (Table V), from a railway Diesel engine again show that the lubrication system did not recognize VI during normal operation at 240°F. oil temperature and 200°F. jacket out temperature.

It is recognized that at low oil temperatures, such as when starting a cold engine, differences in VI are reflected by differences in oil pressure since engine oil pressure is a function of viscosity. Under these conditions of engine operation the importance of using the proper viscosity oil to relieve peak cold oil pressures and increase flow is apparent.

On starting a cold engine (oil cold) a marked increase in oil pressure may be noted. This is a viscosity effect. As the engine warms up the oil viscosity is reduced and oil pressure should drop to normal. If this does not occur in a reasonable length of time, immediate action should be instituted to determine the cause of the high pressure. Conversely, if soon after starting an engine, oil pressure is not indicated the engine should be shut down and the cause of no oil pressure determined.

Detergent or Dispersive Oils

It has been noticed that a change in oil pressure sometimes results after changing from a straight mineral oil to a detergent or dispersive type. It is well known that these oils have a reasonable purging action in an engine. Loosened deposits may clog oil pump screens and intake lines causing reduced oil flow and reduced pressure or they may get by the pump and clog oil galleries increasing oil pressure by limiting oil flow. By cleaning deposits from worn bearing and pump clearances, the increased leakage can cause an oil pressure decrease. It is obvious that some precaution should be exercised in changing from a straight mineral to a detergent and/or dispersive type oil in a used engine. None of these effects were ever noted by changing to a detergent or dispersive oil in newly overhauled or new engines that were in good mechanical condition.

As mentioned previously the oil in a pressure lubricated engine also serves as a coolant. It is therefore desirable to have as high a rate of flow as possible consistent with the amount of oil control provided by the power section of the engine, otherwise excessive consumption can result. An increase in flow resulting from increased bearing clearances can result in lowered oil pressure and may appear to be beneficial from its heat carrying standpoint, however, this may be greatly offset by loss of oil control and the attendant high oil consumption.

Oil Pressure Indications of Engine Malfunctioning

The above discussion and points set forth are not intended to mean that changes in oil pressure are detrimental to engine operation. Most engines in good mechanical condition, operating under a fixed set of conditions and using a specified viscosity grade oil will show a definite oil pressure indication. If, after continued use under the same conditions a change in oil pressure is noted, it is a good indication that something in the lubrication system is not normal. The most common change is that of reduced oil pressure. The amount of reduction that can be tolerated is dependent on the engine design. In some engines relatively small reductions may lead to malfunctioning while in others rather large reductions may not necessarily cause failure although this is not considered to be a desirable condition.

Knowing the engine characteristics with regard to engine oil pressure it is possible to associate engine mechanical malfunctions with deviations from normal engine oil pressure. Some of these malfunctions and their effect on oil pressure are shown in Table VI.

Trends In Lubrication System Design[1]

One of the most important individual problems in a modern automotive engine lubrication system is the journal bearing. A section of a journal bearing with a polar diagram of the oil film pressure is shown as Fig. 17.

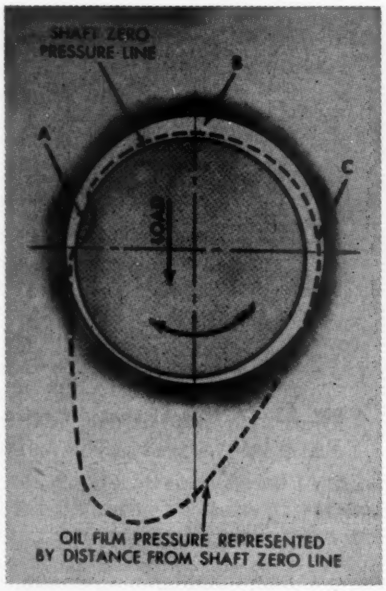
With gravity feed the oil is usually introduced between *A* and *B* and must pass through the region of larger journal clearance to arrive at *C* where it is available to form the oil wedge. Much oil may be lost as leakage while passing through the large clearances.

This oil may not only be lost for lubrication but may be ineffective for cooling. In a pressure system oil may be introduced nearer point *C*, thereby reducing end leakage and having a maximum amount of oil contacting the bearing surfaces for cooling.

The effective length of a bearing is proportional to the length of the area of high oil film pressure (length *A* Fig. 18. The ineffective length caused by end leakage is constant regardless of bearing length, therefore, any change in bearing length affects the high load area directly. Although the change is a small per cent of total bearing length, it can be an appreciable per cent of the

[1] October, 1946, "Wil-Rich Forum". Published by Eaton Manufacturing Company.

Note: Figs. 17 to 25 inclusive, are through the courtesy of the Eaton Manufacturing Company.



◄ Fig. 17—Section of a journal bearing with polar diagram of oil film pressure

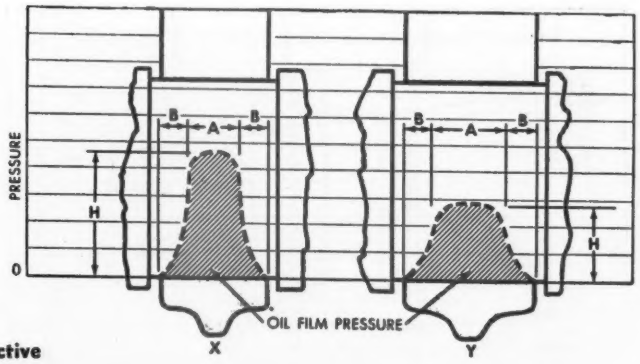


Fig. 18—How the effective length of a bearing is proportional to length of area of high oil film pressure ▲

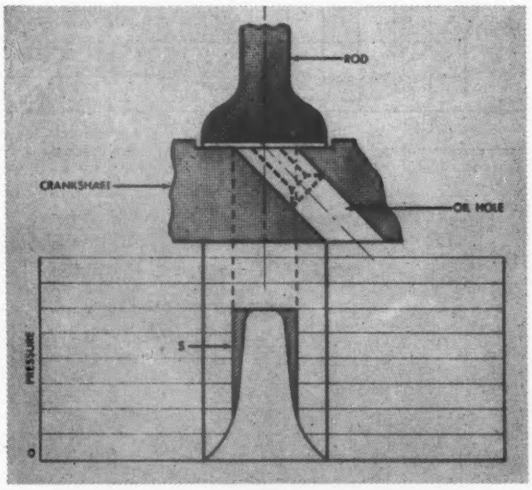


Fig. 19—Modern practice of drilling an angular hole from the main bearing to feed the rod bearing ►

high load area and greatly affect the load carrying capacity. This is illustrated in Fig. 18 wherein two bearings of different lengths carrying the same load are shown. The oil gradient *B* is equal, however, compare *H* and note the difference in bearing pressure.

From the standpoint of bearing cooling it is essential that end leakage oil does some cooling by passing over the journal. However, in some designs the use of an annular groove combined with a longitudinal dirt slot may carry the oil away before it can exert any beneficial cooling.

The modern practice of drilling an angular hole from the main bearing to feed the rod bearing, as shown in Fig. 19, may, in the case of a narrow bearing, remove most of the end seal. The dotted lines are a suggested practice to increase the end seal, adding greatly to the cooling oil contact as well as directing the oil pressure to the loaded bearing oil wedge rather than to its gradient leakage edge. The shaded area *S* in Fig. 19 represents an oil loss resulting from the large oil feed hole.

Some recent studies have shown that the load carrying capacity of a bearing is greatly increased when the load rotation is opposite to the shaft rotation as is the case during the highly loaded portion of the cycle of a rod bearing. Also a bearing can support an instantaneous load much greater than the average load under which it will fail.

Lubrication System Pressures

Fig. 20 shows (A) a schematic diagram of the primary lubrication system in an engine; (B) the effect on pressure of locating the pump and by-pass at the center of the oil gallery; and (C) the effect on pressure with the pump at one end and relief valve at the opposite end of the gallery. The dotted lines indicate pressure gradients for cold oil temperature while solid lines are for normal temperature conditions. In the former (B) peak cold oil pressures are controlled by a reduction in flow while in the latter (C) consideration must be given to line size to keep cold oil pressure and resulting pump drive torque

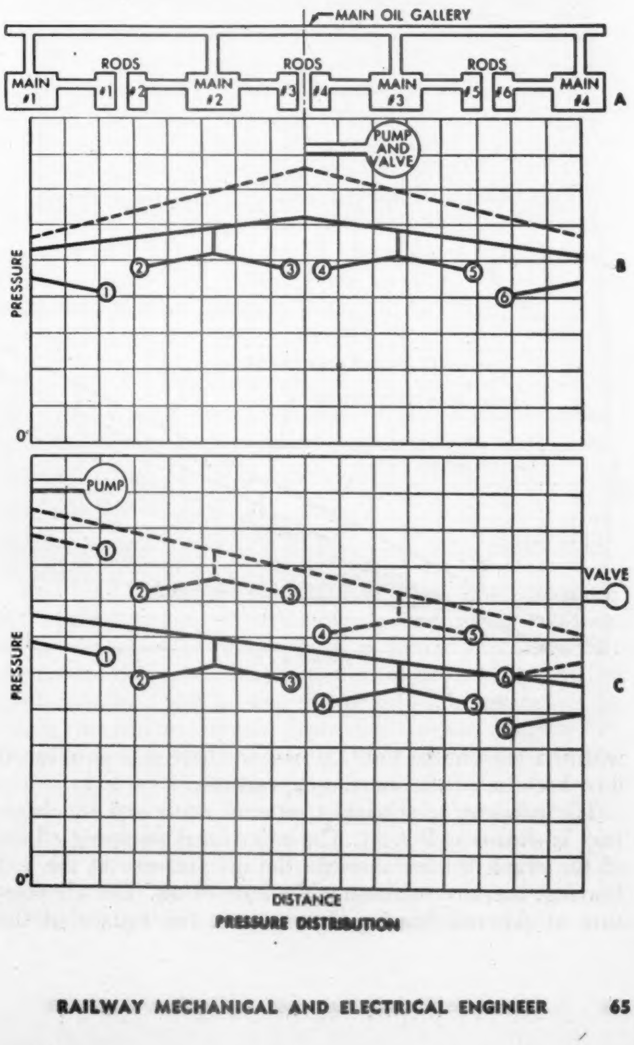
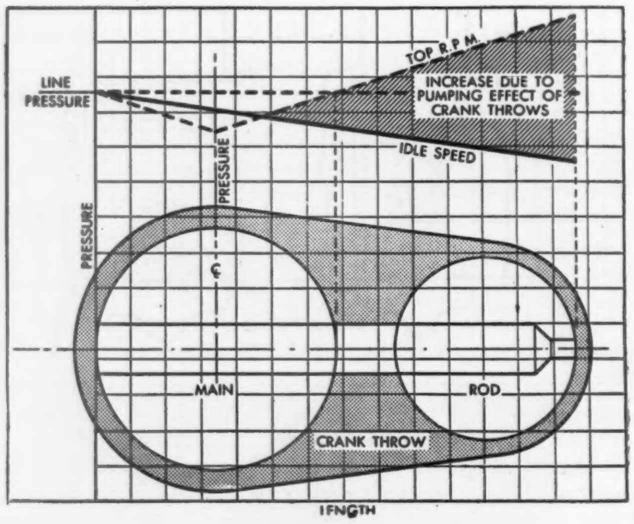
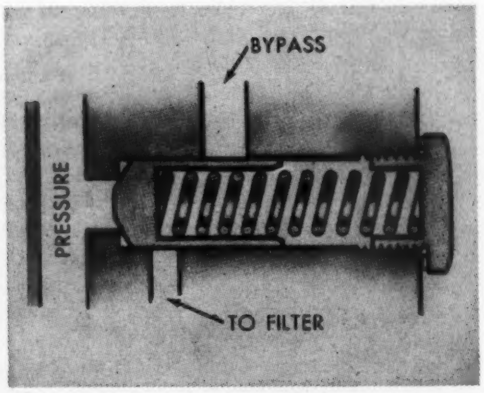


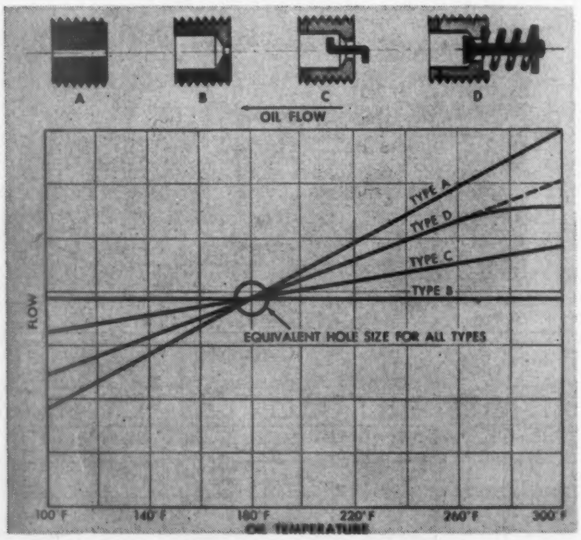
Fig. 20—Schematic diagram of the primary lubrication system of an engine ►





▲ Fig. 23—A type of shut-off valve

◄ Fig. 21—Pressure relationship between main and rod bearings



◄ Fig. 22 — Secondary lubrication can be provided by bleed holes

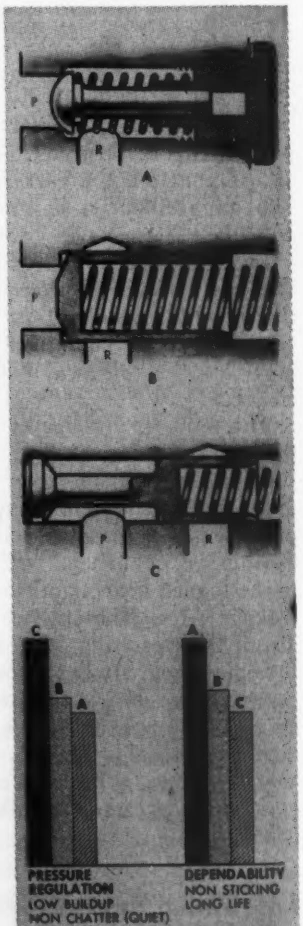
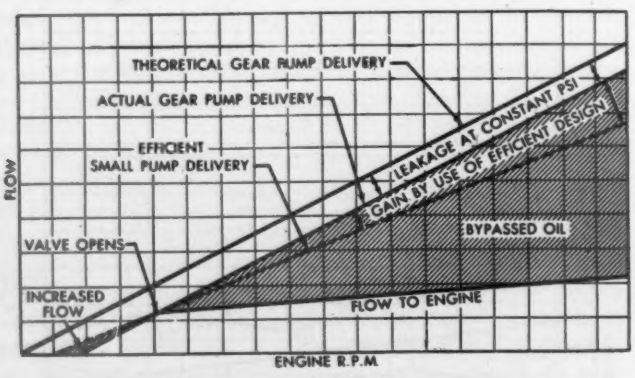


Fig. 24 — Three types of relief valves ►



◄ Fig. 25—Oil pump performance data

within a reasonable limit. However, there is a gain in oil flow because of the increased pressure.

The pressure relationship between main and rod bearings is shown as Fig. 21. The centrifugal pumping effects of the crank throws increase the oil pressure at the rod bearing, thereby increasing the flow of oil. The oil pressure at the rod bearing increases as the square of the speed to approximately 30 p.s.i. at 4000 r.p.m. Bearing temperature varies almost directly with speed. Therefore, an increase in oil flow occurs as cooling needs increase.

Secondary Lubrication

Secondary lubrication is usually provided via bleed holes; four general types are shown with corresponding flow curves as Fig. 22. The orifice size should be determined for the most normal operation temperatures, however, Type A orifices are usually determined at cold

oil temperatures with a resultant increase of flow at the higher temperatures. The knife edge orifice Type B has a discharge nearly independent of viscosity. By using smaller hole diameters more oil is available in the primary system under cold temperature conditions.

A design to decrease danger of dirt fouling, by means of the action of a free piece of wire, is shown as Type C. In this type, hole size can be reduced in view of its annular nature and less danger of clogging whereas in the straight hole type, size of hole is limited to drill size rather than determined by actual oil flow. A shut-off type used to confine oil to the primary system up to a certain pressure, which is usually low, and may be designed to give variable flow, is shown as Type D. This type is often used to isolate the oil filter from the engine at low speeds or it may be incorporated in the engine relief valve as shown in Fig. 23.

It cannot be emphasized too strongly that a squirt hole of 3/32 inch, for ease of production, can actually rob the vital engine bearings of a major portion of engine oil pump flow. Even a 1/16 inch hole is usually too large and a loss through it represents three times as much oil flow as is given to any vital engine bearing. A larger pump capacity cannot always rectify this squirt hole loss. At engine idle with hot oil a 6 g.p.m. at 2000 r.p.m. pump will deliver 0.3 g.p.m. A 10 g.p.m. at 2000 r.p.m. pump will deliver 0.5 g.p.m. at idle. The 1/16 inch hole will flow 0.3 g.p.m. at 50 p.s.i., therefore, pressure cannot be achieved with a 6 g.p.m. pump. With a 10 g.p.m. pump, even if the engine should be tight enough to maintain pressure with a 0.2 g.p.m. flow to the bearings, less than half flow is available for the bearings. There seems to be no compromise from a small properly proportioned oil hole in combination with an efficient pump.

Relief Valves

There are two general types of relief valves, those which by-pass to the sump and those which return oil to the pump intake. These are also divided into wet or dry types, depending on whether they drain dry during periods of non-operation.

With a relief valve incorporated in the pump housing it is usually most convenient to by-pass to the pump inlet. Therefore, the valve should be of the wet type and non-sticking to prevent air leakage and loss of pump prime.

To assure priming, by-passing to the sump would be preferable. The valve can then be wet or dry and sticking not be a priming hazard. If possible the return should be below the oil level to decrease aeration and foaming.

Three types of valves that have proven satisfactory are shown as Fig. 24. Selection, variation and combination of these designs should be to meet the desired characteristics. Types A and B are low pressure types having a larger seating area exposed to pressure when open than when closed, thereby causing the valve to hunt under critical conditions; this may be disastrous in a high pressure system. Type C overcomes this, however, in view of the close fits required, the oil must be kept exceptionally clean.

Aside from dirt, lacquering is a common cause of relief valve sticking. Type C is the worst offender under these conditions. By increasing outside diameter clearances Type B can be improved while Type A is loose and is least affected. Type C is best for accurate pressure control and quietness.

TABLE VI—CONDITIONS AFFECTING OIL PRESSURE

Some factors affecting oil pressure and their indication on the oil pressure gage are as follows:

	Pressure Gage Indications
1. Faulty gage	High or low
2. Clogged line to gage	No movement or delayed action
3. Clogged oil pump screen	Low
4. Faulty oil pump	Low or erratic
5. Excessive main, con rod, camshaft or rocker arm arm bearing clearances	Low
6. Clogged full flow filter (provided by-pass is inoperative)	Low
7. Insufficient oil filter restriction	Low
8. Ineffective oil cooler, depending on type, may keep oil too cold or provide insufficient cooling	High or low
9. Crankcase oil level just at or below oil pump pick-up	Erratic, then low, eventually none
10. Use of excessively low viscosity oil	Low
11. Use of excessively high viscosity oil	High
12. Excessive fuel dilution	Low
13. Excessive contamination	High
14. Clogged oil passages on the pressure side	High
15. Enlarged squirt holes	Low
16. Impr oper setting or failure of pressure relief valve	High, low or erratic
17. Oil lines or line fittings broken, cracked or loose	Low
18. Oil pump drive gears stripped or drive broken	Low, erratic or none
19. Oil too cold	High
20. Restrictions in oil pan or oil too viscous to keep oil pump intake supplied	Low or erratic
21. Oil pump pick-up stuck high	Low or none

Oil Pumps

Engine designers have increased lubrication points as they have become lubrication conscious but with modern auto styling oil pans have been reduced in size, thereby limiting the size of oil pump that can be installed. Therefore, the problem cannot be solved by merely increasing pump size. In the past large manufacturing tolerances were employed resulting in large pump clearances despite the fact that in a capillary-sealed pump the leakage varies as the cube of the clearance. The pump was selected so that the discharge equaled requirements.

It is usually desired to reach relief pressure by 1,000 engine r.p.m. (500 pump r.p.m.) and if possible maintain full pressure at idle or at a time when pump efficiency is lowest. From Fig. 25 it can be seen that the leakage of a conventional gear pump is constant at a given pressure so that at a lower r.p.m. leakage forms a larger portion of the total discharge. Thus a pump with 80 per cent efficiency at 1,000 r.p.m. (pump) has 20 per cent efficiency at 250 r.p.m. The dotted lines in Fig. 25 show the performance of a smaller pump with good low speed efficiency. It was designed to give the same flow as the first pump at the r.p.m. at which the relief valve opens. As a result it gives more oil up to the point at which the valve opens and less by-passed oil beyond this point. This action can also be applied to giving more oil throughout the low speed range without increasing top flow and pump drive power.

Conclusion

The lubrication system is the life line of an engine; any malfunctioning in this system may lead to serious engine failure. Therefore, it is a primary requisite in engine operation to maintain the lubrication system in good condition and to use the proper lubricating oil to obtain maximum service from the engine. Engine oil pressure is used to indicate oil flow in the lubrication system, but at times the significance of variations in engine oil pressure is not completely clear, therefore, before conclusions are drawn regarding changes in engine oil pressures, the characteristics of the engine with respect to oil pressure and/or previous experience on the engine in this respect should be ascertained.

Press Removes Hyatt Outer Races

Removal or application of Hyatt roller bearing outer races for inspection or renewal of wear plates is accomplished in from 15 to 30 seconds on a press built at the Pegram shops of the Southern at Atlanta, Ga. The press consists of a suitable frame and two double-acting hydraulic cylinders. The top cylinder is 6 in. diameter with a 14-in. stroke and the bottom cylinder 8½ in. diameter with a 2-in. stroke. The bottom cylinder is larger in diameter than the top to hold the journal box in position against the pressure of the top cylinder when pressing the race in. This is necessary because the box is supported on the bottom piston shaft during application of the race. The support is through a ball joint to compensate for any irregularities in the outside surface of the box. The box is held in place when pulling the outer race by a fixed center plate. It is moved back and forth on a four-wheel cart in the center of which a hole has been cut so that the bottom hydraulic piston can contact the box directly.

In pressing the outer race out the box is loaded on the cart either by an overhead crane or by a jib crane. The cart is rolled over the bottom piston and the piston raised until the inner face of the box contacts the center plate, and the opening in the box is aligned with the 12¾-in. hole in the plate. A shaft extension is keyed to the top piston rod of the press, and a pulling piece mounted to the shaft with a pin. The pulling piece is 4½ in. by 9½ in. with the edges rounded off to the diameter of the race. It removes the race through engagement with the bottom edge. The overall time for the operation, including all set-up work, averages from 3 to 5 minutes.

For pressing a race in, the box is mounted on the cart as before but is supported on the lower piston through the hole in the cart. A plate 12½ in. in diameter and keyed to the top piston rod contacts the top of the outer race and presses it in until it seats against the filler piece of the box.

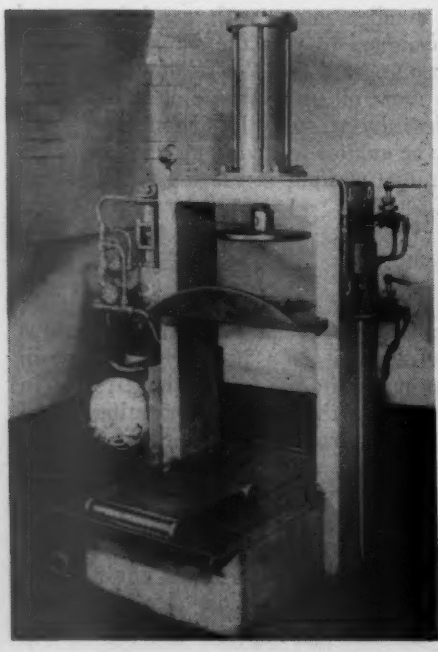
Construction Details

The cart which supports the box for aligning with the hydraulic cylinder and during the pressing out operation of the race rides on four steel wheels ⅝ in. by 2½ in. in two slots ¾ in. by ¼ in. in the base of the press. The cart body is 11¼ in. wide by 13 in. long. The opening through which the box is supported on the lower piston when the race is being pressed in is 7½ in. wide and irregularly shaped lengthwise.

The center plate which restrains the box while pressing out the race is made of 1$\frac{1}{16}$-in. plate with two flanges added for rigidity. A second press to be built will have a 1½-in. plate and no flanges. The bottom of the plate is 21 in. above the base of the press, and it is 13¼ in. from the top of the plate to the bottom of the top frame member. The distance from the sampson to the bottom of the plate which presses the liner in is 10¼ in. The filler plate used for height adjustment with the bottom hydraulic cylinder is 11¼ in. by 12¼ in. by 1¾ in. The need for this plate will be eliminated on the new press which will have a 4-in. stroke on the bottom cylinder, in place of the 2-in. stroke on the present bottom cylinder.

The columns of the press are steel forgings 3 in. by 9 in. on which the hydraulic cylinders are bolted in place. A slot 1 in. deep is cut into the side and the center plate fits into and is supported by these slots. The pumping pressure is generated by a hydraulic pump, Vapor model CF 4225 steam generator water pump, belt-driven by a 2-hp. electric motor. The oil reservoir is in the base of the press and comprises a metal box 18 in. by 23 in. by 11¼ in. made of ¾-in. plate. The top plate of the base is 35¼ in. by 23 in.

Hydraulic press (left) which applies or removes Hyatt roller-bearing outer races in ½ min. The dolly which supports the box is shown with the filler plate for pressing the race in. The complete operation for applying the outer race, including set-up time, requires from 3 to 5 min. The arrangement for removing the outer race is shown at right



Crankshaft Removal Stand

Crankshafts are removed from diesel engines at the Citico shops of the Southern at Chattanooga, Tenn., on a revolving stand that permits positioning the engine at any desired angle. The engine is bolted upright on a pair of longitudinal members of the stand by an overhead crane. The engine is revolved until it is upside down, at which position the bottom halves of the bearing supports are removed and the crankshaft can be lifted clear of the engine by the crane.

The main vertical supports of the stand are two 40-in. lengths of 6-in. flues. To the top of each vertical support is welded a 12-in. length of a 6-in. flue. The latter flues form the bearings about which the engine is revolved.

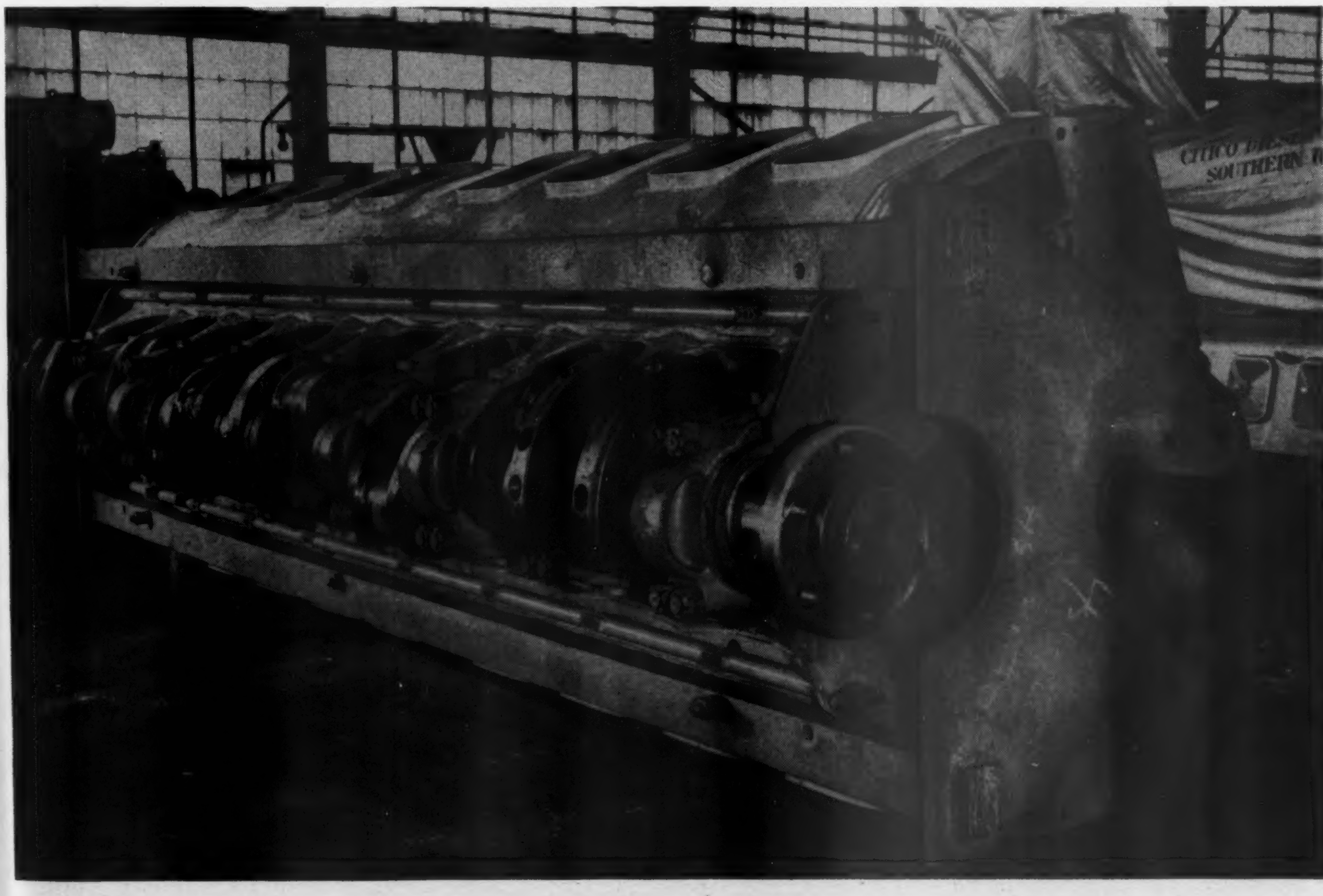
The shaft on one end of the stand is integral with a circular plate 1 in. by 27 in. This plate is welded to a second plate which is shaped similar to the end sections of the engine and which is welded to the longitudinal engine supports. The circular plate has eight 1-in. holes 2 in. in from the outside edge of the plate. Pins fit through these holes and through a hole in the upright to lock the stand with the engine in the desired position for removing the crankshaft. The shaft on the opposite end is joined directly to the plate shaped similar to the engine end contour.

The two supports to which the engine bolts are 3 in. by 4 in. in cross section. Each support has five holes to accommodate the five ¾-in. bolts which secure the engine to the stand. After the engine is securely bolted in place, the stand is revolved by an air motor through reduction gearing.

Permits Inspection of Warm Crank-Shaft Bearings

When a diesel locomotive enters the enginehouse and it is desired to mike the main bearing inserts, no delays are

Leverage arrangement for handling warm bearings when the inserts are to be miked



Stand for applying or removing diesel engine crankshafts

encountered from the bearings being too warm to handle with the bare hand if the leverage device, shown, is employed.

The lifter is in two parts, a small bent fulcrum plate and a long lever with the load end of a concave shape to the approximate contour of the bearing cap. The bent plate rests on the bottom of the inspection opening. The lever contacts the fulcrum plate through a small support pinned to the lever. With the load end of the lever in place under the bearing cap, lowering the free end to tend to raise the cap takes the load off the bolts for easy removal of the nuts. The cap, held in the concave end of the lever, can then be lowered to slip the insert out for miking.

Storage Racks for Top Deck Covers

Diesel locomotive top deck covers are stored neatly and conveniently in an eastern enginehouse on racks located at convenient intervals along the servicing ramp, each rack holding eight covers. The racks rest on a skid made of brake beam backs and can be easily removed from one location to another by fork truck when desired.

Each rack is 37 in. deep by 44 in. wide by 31 in. high and made of 1/8-in. steel plate. The covers rest on wood strips 1/4 in. by 1 1/2 in. which are bolted to strap iron supports 3/16 in. by 1 1/4 in. The strap iron sections are in general shaped to the contour of the cover and have an arch in the center to accommodate the cover handle. The skid on which the storage rack rests is 43 in. long by 53 in. wide by 14 in. high. The racks are of all welded construction except for the bolts which secure the wood to the strap iron.

Rack Wheels Diesel Trucks

Personnel at the Southern shop at Spencer, N. C., have built a rack which aids in disassembling, assembling and aligning diesel locomotive trucks. The rack rests on a pair of floor level rails, and the truck is placed on it by a crane with wheels resting between V-blocks welded on the frame of the rack.

The rack consists essentially of two lengths of strap iron 1 in. by 3 in. which rest on the shop rails. The two lengths are held together by two scrap steam locomotive guides welded to the strap iron at intermediate points along the

A top deck cover storage rack mounted on a skid for easy portability

Rack for aligning wheel sets on four-wheel diesel trucks preparatory to assembly

length and by two tie rods that join the ends. The rack is held in proper relationship to the track by small sections of plate near the ends of the tie rods which contact the inside edges of the rails. In the center of each cross bar made from the locomotive guide is a steel bar 11 in. long and with a cross section 1¼ in. by 3 in. Each bar is pivoted about the bottom and swings to a vertical position to support the traction motor when assembling or dismantling the truck.

In dismantling a truck the overhead shop crane is hooked in the traction motor eye and the motor lifted to remove the motor suspension spring. While the motor is held up by the crane the bar is pivoted to a vertical position and the traction motor suspension lug lowered onto the bar to hold the wheel set with the traction motor in the desired position.

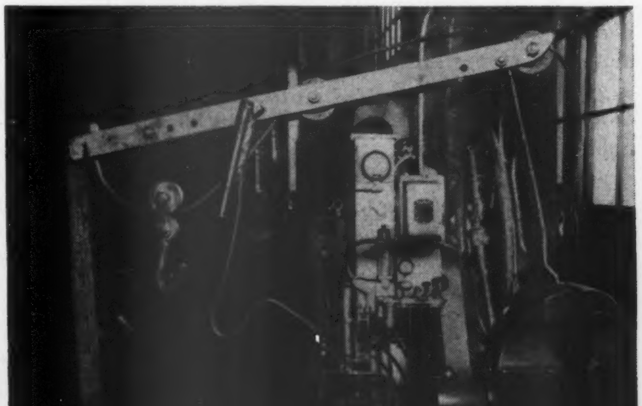
When a truck is to be rebuilt the wheels are set in the pockets formed by the wedges, which automatically realign the truck. The wedges that hold the wheels in place are 1 3/4 in. thick, 4 in. high and 7 in. long. The pairs are properly spaced from each other for aligning and squaring four-wheel trucks.

Derrick for Use Inside Locomotive

The removal of cylinder heads and liners from diesel engines within the locomotive is simplified by the use of a light portable derrick. The derrick consists of a short vertical member and a long horizontal member with a cable and drum mounted on the former, a pair of pulleys and a hook on the latter. The drum used for raising and lowering the liner or head, as the case may be, is equipped with a ratchet to hold the load in any desired position.

The vertical section of the derrick rests on the air baffle. and the end of the horizontal section opposite the vertical section rests on the rail support channel. This puts the horizontal section near the ceiling level and permits raising the cylinder head or liner high enough to swing it clear of the engine.

The shape of the liner lifting attachment is such that the liner can be tilted after raising to swing it clear of the engine for removal. The liner attachment has a length of pipe which fits over one of the liner studs and is secured in place with a nut on the stud. The remainder of the liner lifting attachment fits inside the liner. A short length of rubber hose is affixed to the bottom of this attachment where it touches the liner to prevent scoring.



Derrick for removing cylinder heads and liners from diesel engines within the locomotive propped up on shop floor in position in which it is used. The left end, supported by stick, rests on rail support channel. The right end, clamped in the vise, fits on air baffle. Suspended from horizontal member to the left of center pulley is the attachment for lifting the liner

QUESTIONS AND ANSWERS

Diesel-Electric Locomotives

Alarm and Indicator Lights

208-Q.—When does the wheel slip light function? A.—If one pair of wheels slip the white wheel slip light will come on.

209-Q.—What else takes place? A.—The buzzer will sound and generator output is reduced.

210-Q.—Explain this arrangement. A.—Two wheel slip relays are provided per unit, one across the No. 1 and 4 traction motors and one across the No. 2 and 3 motors. When slippage occurs, there is a difference in current between the two fields.

211-Q.—Suppose there is a repeated wheel slippage? A.—The throttle should be partially closed and then gradually re-opened.

212-Q.—What should be done if it is necessary to use sand? A.—Throttle should be reduced, to stop flashing of the wheel slip light before applying sand.

213-Q.—What happens during transition? A.—The wheel slip light will light for an instant during transition from 2 to 3, or 3 to 2.

214-Q.—Is this an indication of wheel slippage? A.—No.

215-Q.—What is the purpose of the Crank Case Exhauster light? A.—This yellow light indicates that the crank case exhauster motor is running.

216-Q.—When does this light come on? A.—When the fuel pump switch on the Engine Control Panel is turned ON.

217-Q.—How long should this light be ON? A.—Continuously whenever the Diesel engine is running.

218-Q.—If the light goes out during operation, what does it indicate? A.—It indicates that either the exhauster motor has stopped or the lamp has burned out.

219-Q.—What is provided on locomotives equipped with Dynamic Brake? A.—A white dynamic braking warning light and relay.

220-Q.—How do these parts function? A.—When the relay closes, the warning light at the engineer's position will light, indicating that the load on the dynamic brake is excessive and should be reduced.

Diesel Engine

Description of Parts
Valve Operating Mechanism

221-Q.—How are the air inlet and exhaust valves operated? A—From two cam shafts mounted on the engine frame.

222-Q.—How are the cam followers constructed? A—They are of the crosshead type with hardened rollers.

223-Q.—What operates the valve levers? A—Push rods in contact with the cam followers operate the valve levers through the valve adjusting screws.

224-Q.—Where are the valve adjusting screws located? A—In the push rod end of the valve levers, the other end of which bear against the equalizing yokes through a ball and socket joint.

225-Q.—How do the equalizing yokes function? A—They operate two air and two exhaust valves per cylinder, each pair of valves being operated from a single cam, push rod and valve lever.

226-Q.—How about the opening of the valves? A—As the equalizing yoke slides up and down on a guide rod, both valves open the same amount.

227-Q.—What provision is made for differences in valve stem lengths? A—An adjustment is provided to compensate for difference in valve stem lengths or depths of seat from regrinding valves.

228-Q.—From where is lubrication of the valve lever mechanism provided? A—From a lube oil header along each bank of cylinders.

229-Q.—How is the assembly lubricated? A—Individual lines conduct the oil to the valve lever shaft and then to the valve lever bushings. Drilled holes through the valve levers lead from the bushings to the equalizer yoke ball joint. Excess oil from this ball joint lubricates the yoke guides and the valve stems. Another drilled hole conducts the oil to the ball end adjusting at the opposite end of the valve lever.

230-Q.—What becomes of the excess oil? A—All excess oil flows down the push rod, lubricating the cams and cam followers.

Cylinder Heads and Valves

231-Q.—What type cylinder heads are used? A—Individual high strength cast iron cylinder heads are used on each cylinder.

232-Q.—How are the heads secured? A—To the engine frame by seven studs.

233-Q.—What valves are in the cylinder heads? A—Four identical valves are in the cylinder head: two exhaust and two air.

* This series of questions and answers relates specifically to the Alco-G.E. diesel-electric locomotives.

Steam Locomotive Boilers

By George M. Davies

Injector Steam Consumption

Q.—How does the steam consumption of an injector compare with that required by a boiler feedwater pump used in conjunction with the feed water heater equipmnt?—F.E.D.

A.—The amount of steam used by injectors for boiler feeding is a fairly constant quantity for a given size in-

jector, and will vary from 3,500 to 5,000 lbs. per hr. All of the heat in the steam above that required for actually pumping water into the boiler against boiler pressure is returned to the boiler as heat in the feed water. The efficiency of the injector as a pump alone is not over two per cent, so that the net steam charged to the injector is negligible.

The quantity of steam used by boiler feed pumps varies from two to five per cent of total steam generated. The exhaust from the boiler feed pump is usually returned to the feedwater heater with a consequent recovery of a part of the heat in the pump exhaust. This will reduce the quantity of steam actually used by the boiler feed pump to a relatively small amount.

Effects of Water In the Dry Pipe

Q.—What are the effects of water carry over into the dry pipe of a locomotive boiler?—R.E.L.

A.—Water carry over into the dry pipe of a locomotive boiler directly affects the superheater. Moisture in the steam must be evaporated in the superheater and for each 1 per cent of moisture entering the superheater there is a decrease in superheat of approximately 15 deg. F. Also the scale deposits in the water carry over accumulates in the superheater units retarding the steamflow and velocity through the units resulting in superheater unit failures.

Reinforcement Requirements

Q.—Our specification for all-welded shells requires that longitudinal, circumferential and other joints uniting the plates of the boiler shell or other parts shall be of the double-welded butt type and shall be reinforced at the center of the weld on each side of the plate by at least 1/16 inch up to and including 5/8 inch plate and up to 1/8 inch for heavier plates. Is this reinforcement required in order to maintain the efficiency of the seam?—M.R.V.

A.—The A.S.M.E. Power Boiler Code provides that all longitudinal, circumferential and other joints uniting the plates of the drum, shell, or other pressure parts, shall be of the double-welded butt type and shall be reinforced at the center of the weld on each side of the plate by at least 1/16 inch up to and including 5/8-inch plate, and up to 1/8 inch for heavier plates. The allowable efficiency of such seams, provided the welding meets all test requirements, is 95 per cent provided all weld reinforcement is removed substantially flush with the surface of the plate, machined off, otherwise a joint efficiency not to exceed 90 per cent shall be used.

Schedule 24 RL Air Brakes

Automatic Train Control

1125-Q.—How may this brake application be forestalled? A.—It may be forestalled by the engineman if an acknowledging device is operated before passing the wayside signal.

1126-Q.—What essential apparatus is used with the Speed Cotnrol systems? A.—(1) Service brake application valve; (2) Timing valve; (3) A-1 Suppression valve; (4) Single pointer air gage; (5) Duplex air gage; (6) Cut-out cock; (7) Second reduction reservoir; (8) Suppression reservoir and (9) Suppression timing reservoir.

1127-Q.—What essential apparatus is used with the Continuous Automatic Stop System? A.—Items 1, 2, 4, 6 and 7 above and Stop Reservoir.

1128-Q.—What apparatus is used with the Cab Signal System with whstle and acknowledger? A. — Whistle magnet and bracket assembly or NM-1 reducing valve and magnet assembly.

1129-Q.—What essential apparatus is used with the Intermittent Automatic Stop System? A—(1) Magnet and bracket; (2 Acknowledging valve; (3) Reset cock; (4) Cut-Out cock; (5) Acknowledging Reservoir and (6) Second reduction reservoir.

Train Control Operation

1130-Q.—From where is the train control system charged? A.—The train control system is charged by main reservoir air from the brake valve and by air at reduced pressure from the NS-1 reducing valve.

1131-Q.—What does the reducing valve consist of? A.—A pipe bracket *2*, in which are mounted check valve portion housed in body *11*, the cut-out cock portion housed in body *53* and the reducing valve portion housed in body *18*.

1132-Q.—How does the check valve portion function? A.—It permits reducing valve air to flow to the system but prevents any back flow.

1133-Q.—How does the cut-out portion function? A.—It provides means of cutting off the air supply to the system.

1134-Q.—How does the reducing valve portion function? A.—Reduces the supply air to a predetermined amount.

1135-Q.—Explain the operation of the reducing valve when charging. A.—Main reservoir air enters the valve through passage *s* and flows to supply chamber *C*. Spring *47* has moved diaphragm follower *41*, exhaust valve seat *39* and the exhaust and inlet valves upward.

1136-Q.—What then happens? A.—This unseats the inlet valve and supply air from chamber *C* flows past inlet valve seat *31* into chamber *B* and passage *r* to the system and to the check valve *12*.

1137-Q.—What other flow of air occurs? A.—The air also flows through choke *D* to chamber *A* on top of diaphragm *40*.

1138-Q.—What happens when air pressure in the system and chamber A reaches the amount for which the adjusting screw 45 is set? A.—The air pressure and spring *38* move diaphragm *40*, follower *41* and exhaust valve seat *39* downward. Inlet valve spring *34* moves inlet valve down on its seat *31*, cutting off further flow of air.

1139-Q.—What action takes place if the pipe to the timing valve ad chambers B and A are charged to pressure in excess of the setting of adjusting screw 45? A.—In this case, air pressure and spring *38* move diaphragm *40* and exhaust valve seat downward so that the exhaust valve is unseated.

1140-Q.—What is the result of this movement? A.—The overcharge of air from chambers *B* and *A* is permitted to flow past unseated exhaust valve seat *39* into the spring housing *43* and through the exhaust port to atmosphere. As the setting of the adjusting screw is reached in chamber *A*, spring *47* moves diaphragm follower *41* and exhaust valve seat *39* to seat the exhaust valve, preventing further flow of air.

ELECTRICAL SECTION

Load Testing Axle Generators

Variable-speed drive for load-testing 1½- to 15-kw. generators developed in Los Angeles General Shops of the Southern Pacific

*By J. C. Alvarez and Fred Lewis**

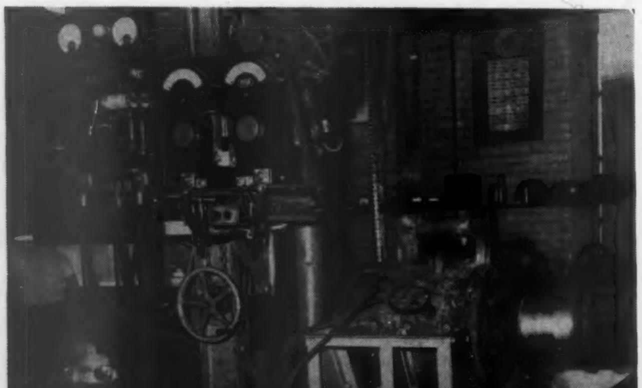
THE LOAD tester shown in the illustrations was built in response to a need for testing axle generators in the shop under road operating conditions. It was constructed by the authors using material on hand under the supervision of A. E. Lines, departmental foreman of electricians.

The tester provides for driving the 1½- to 15-kw. generators under load at all of the speeds encountered in service. It consists basically of a motor generator set which supplies power to a variable-speed motor which is used to drive the generators under test. A belt drive is used for the smaller generators (which are belt-driven in service) and direct drive is used for generators ranging in size from 7½ to 15 kw.

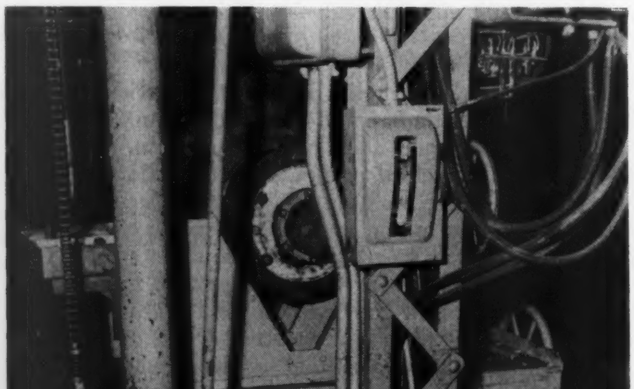
The motor-generator set is an old electric welder which consists of a 440-volt, three-phase, a.c. motor driving a generator rated 300 amp. at 50 volts. Its voltage is controlled by a rheostat as shown in the diagram.

The variable-speed motor, driven by the generator, is separately excited as shown in the diagram. It is fitted

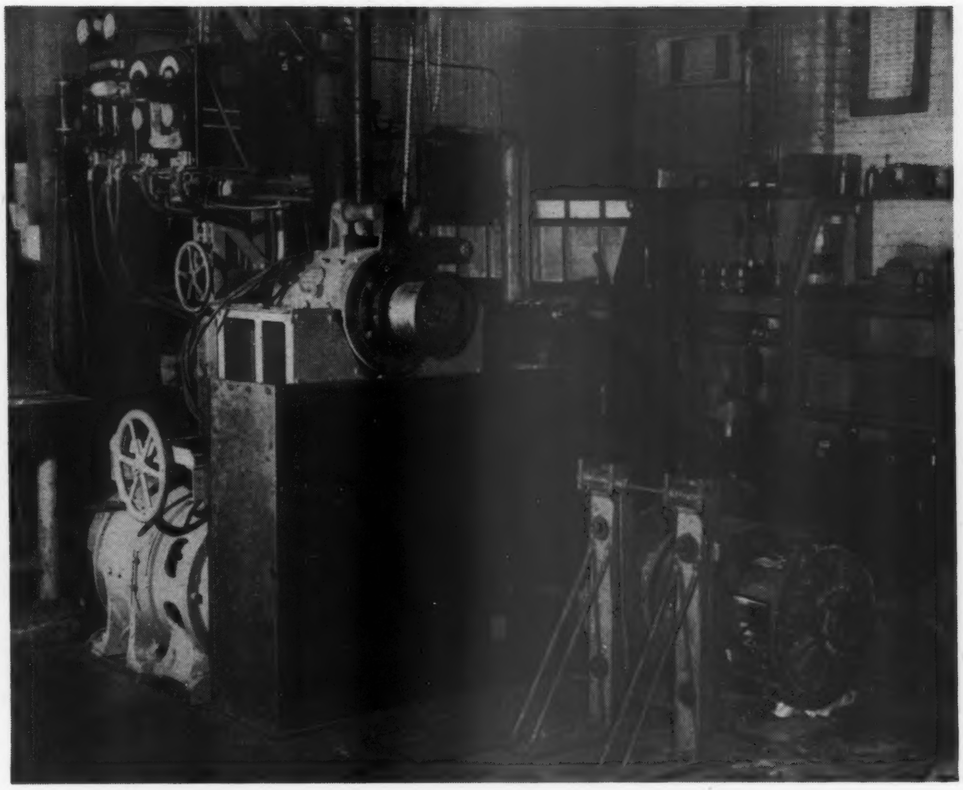
* Electricians, Los Angeles General Shops, Southern Pacific Company, Los Angeles, Cal.



Front of the drive showing the m.g. set in front and a small axle generator in the V-mount. The motor control panel with motor and generator rheostats is on the column. The axle generator control panel is on the bracket at the left



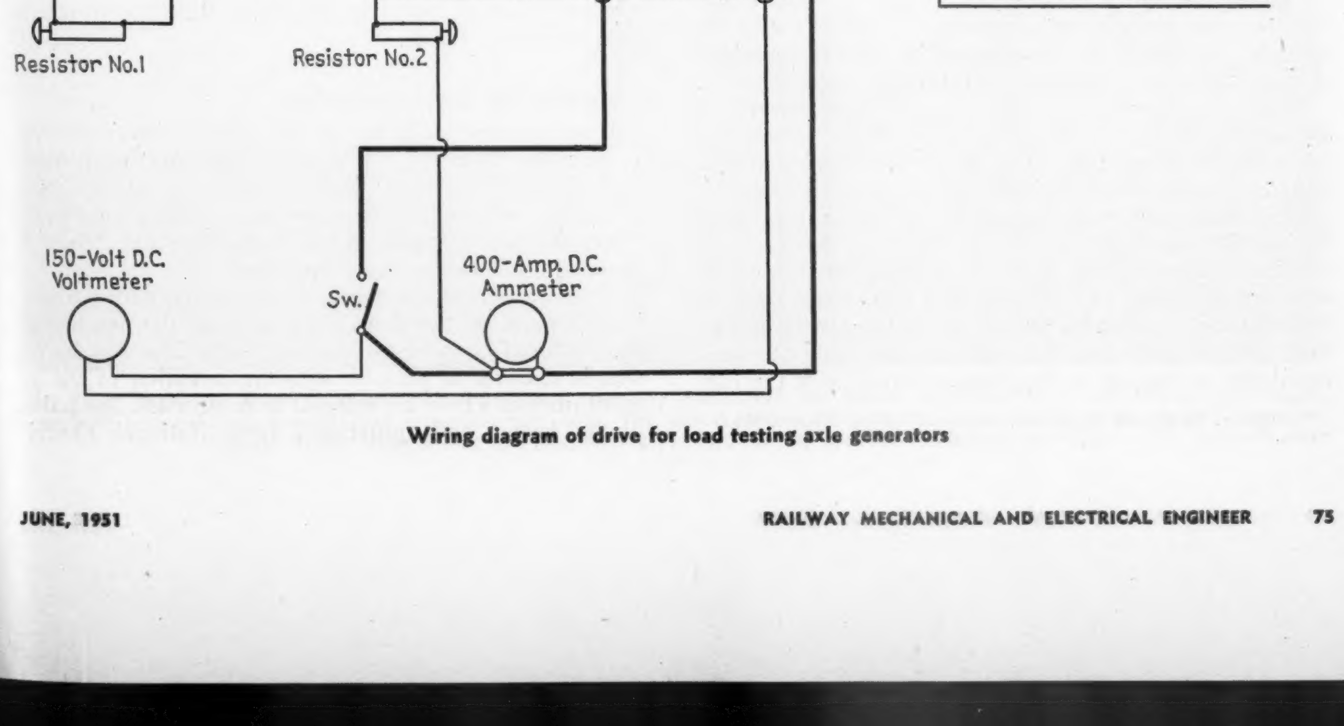
Back of the drive showing a small axle generator in the V-mount, the variable-speed motor, lower left, and the m.g. set, lower right. Tre chain hoist is used for placing the generators under test



Front of the drive, showing the m.g. set, lower left, a small axle generator (not bolted) in the V mount, and at the lower right a large axle generator directly connected to the variable-speed motor behind the belt guard

with an 8-in. pulley which is used for a flat-belt drive to the smaller generators which are placed in the V support shown at the top in the large photograph. This V mounting is on a carriage which can be moved back and forth by means of the handwheel shown at the left. After a belt is applied, the handwheel is used to obtain the required belt tension. In the same illustration, the motor-generator set is shown, lower left, and at the lower right is a large generator under test which is directly connected to the flange fitting on the end of the 8-in. pulley on the variable-speed motor.

Generators under test may be driven at speeds ranging from 200 to 2,200 r.p.m. The test is made at 40 volts, and the current range is 200 to 325 amp. Generators under test are loaded on an Allen Bradley grid resistor bank.



Wiring diagram of drive for load testing axle generators

Motors undergoing light run tests. Five motors are processed through the shop and tested in a group.

Operation of the Southern's Electrical Repair Shop

Many improved methods, including batch-handling of motors, have increased shop efficiency and insured long service on the road

*By R. H. Herman**

THE article in the May issue of *Railway Mechanical and Electrical Engineer* discussed in detail the layout of machinery and equipment in the Southern's traction motor and generator repair shop at Atlanta, Ga. While the ultimate layout will not be completed for some time, the operating procedures have been well established and no difficulty should be experienced in future expansion of these facilities to take care of full requirements.

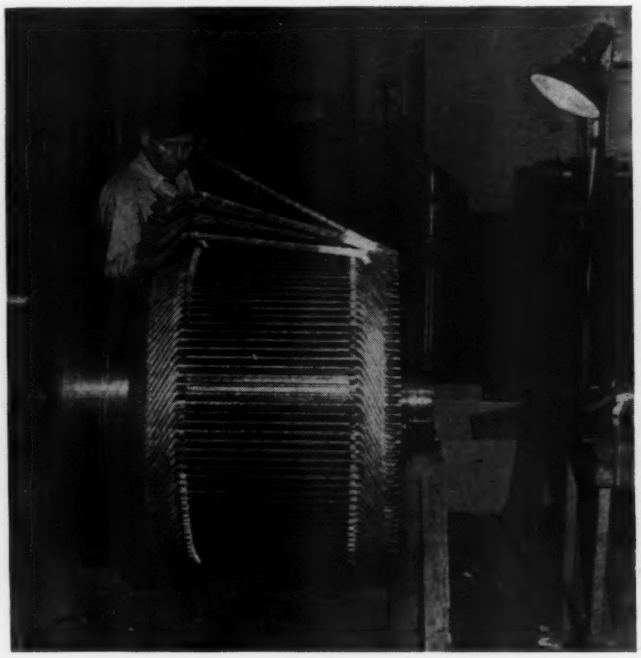
Traction motors, main generators, auxiliary generators and small motors are shipped to and from Atlanta in box cars, gondolas or flat cars. It is extremely important that this equipment be loaded and protected in such a manner as to eliminate damage due to rough handling. Special flat cars are now being used for shipment of traction motors. These cars are fitted with structural steel cradles bolted to the floor, with braces and rods to hold the motor securely, preferably with the axis of the shaft parallel with the car axles. This eliminates any possibility of damage to bearings or brackets if the car receives a severe bump which would shift the armature laterally in the frame.

* Engineer, Shops and Equipment, Southern Railway System, Washington, D. C.

Dismantling and Inspection

Upon the arrival of the car at Atlanta, the equipment is unloaded from the car by an outside overhead crane and placed on trailers or floats. Gasoline tractors are used to pull the trailers from the storehouse to the repair shop, where they are unloaded in the dismantling and stripping area, adjacent to the vapor degreaser.

Traction motors are received in the shop with the pinions in place on the shaft, since it is not the practice of the Southern to match pinions and gears. The first operation is removal of pinions, with the exception of the 12 tooth pinions which are integral with the shaft. Induction pinion heater coils purchased from National Electric



Rewinding a main generator armature

Applying band to generator armature

Coal Company are used to heat the pinion, after which it is removed by wedges, supplemented when necessary by a Rodgers hydraulic pinion puller. Coils of different sizes are provided to suit the full range of pinion outside diameters.

After removal, the pinions are carefully checked for cracks or defects by visual and Magnaglo inspection. The pinion is slipped over a copper bar and current from the power unit passed through the bar to magnetize the pinion. A solution of Magnaglo paste in a light oil is brushed over the pinion after which it is inspected for defects under black (ultraviolet) light. The entire operation is performed in a curtained enclosure. This arrangement has proven very satisfactory for locating cracks or defects at any location on the pinion, although particular attention is given to the area at the root of the teeth. After dimensional checks, the pinion is stored until it is re-applied to a motor.

In the meantime, the foreman in charge makes a careful inspection of the motor before and during dismantling and fills in information on a form titled "Motor Inspection on Arrival." If the shipping point has reported the

Left: Vapor degreaser is served by the 10-ton overhead traveling crane. Note the special angle-iron racks with hooks and brackets to support bearing caps, bearings and miscellaneous parts. The entire rack is lifted by the crane and lowered into the degreaser tank. Right: Dismantling and stripping area. Five motors are dismantled at one time

Left: Traction motor and generator armatures are balanced in a Gisholt Dynetric balancing machine. Right: Bearing assemblies are inspected for defects by means of an eight-power magnifying glass.

motor removed from service due to defect or failure, the form is stamped "Failure—Inspect for Cause" and the foreman examines the motor in an effort to determine the cause of failure. At the same time, the mechanic fills out a detailed form covering condition, dimensions of critical parts, etc., and a job number is assigned to cover both the armature and the frame.

Five Motors at a Time

An interesting feature of the operation is the practice of processing five traction motors through the shop at a time. Five motors are set on stands, approximately 12 in. high, and stripped simultaneously, while five armatures and five frames are progressed through the degreaser, bake ovens, vacuum impregnator, etc., up to final assembly. This arrangement permits full use of the various items of equipment and has reduced labor costs for handling.

Brushholders are inspected and overhauled at a special bench. They are then stored in a cabinet with glass fronted doors

The motor is completely dismantled in the area adjacent to the degreaser. Axle bearing caps, axle shield, housings, bearing assemblies, oil throwers, brushes, brush holders and other parts and removed and transferred to work benches where they are checked for dimensional tolerance and reconditioned for further service.

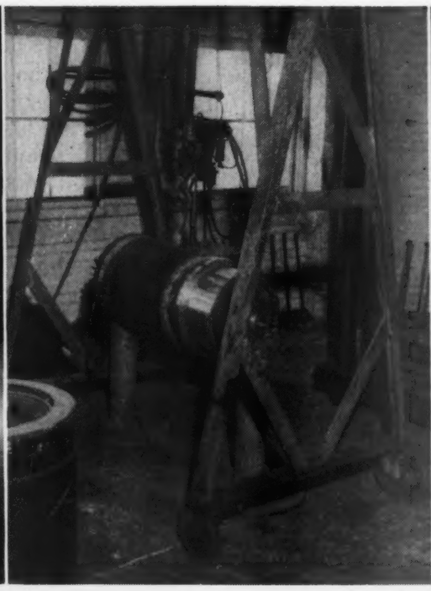
Bearing assemblies are cleaned in the degreaser, after which they are passed into the bearing overhaul room. They are dipped into tanks of mineral spirits and blown off with compressed air. This procedure leaves a thin film of oil which provides protection against corrosion. The bearing is carefully inspected by means of an eight-power magnifying glass for any indications of pitting, shellout, flat spots on rollers, burns of any nature, loose rivets on the retainer cage or any fissure or cracks. If there is any doubt as to condition, the bearing is condemned and returned to the manufacturer for reconditioning. Defective inner races are replaced, but a defect in rollers or cage will condemn the entire bearing. If the bearing is found to be satisfactory, it is given a coating of No. 10 oil and stored for further service.

Frame Overhaul

Traction motor frames are carefully inspected for loose or chafed field or interpole coils, indications of thrown solder and condition of insulation on coils and connections. No electrical tests are made before cleaning, and after inspection, the frame is placed in the degreaser for a period of approximately 20 minutes. It has been found that the degreasing process will clear up partial grounds or other conditions which would show low resistance readings if tests were made upon arrival of the motor in the shop.

It is necessary to remove dust, paint and scale, after the frame is lifted from the degreaser tank. This is now done by hand with wire brushes and then blowing with compressed air. A soft abrasive blast outfit is on order and when installed will permit the operation to be performed in a more efficient and economical manner.

It is the practice at Atlanta to carefully inspect the



Left: Slots in armature core are thoroughly cleaned with a motor-driven wire brush before rewinding. Center: Stripping coils, wedges and insulation from an armature core using a 1-ton electric hoist on an A-frame and a come-along to grip the coil. Right: Interior of cleaning and paint spray booth

motor leads on the outside of the frame on all motors going through the shop. The cable blocks are removed, tape and twine removed, and the cables are separated and turned back to permit thorough inspection at the locations where the cable enters the frame through the grommets or rubber bushings. If no defects are found, the cables are secured with heavy twine, retaped, painted and entrance locations sealed with asphalt compound. The care taken in this operation is reflected in the fact that no grounds have devloped on the motor leads on any motors turned out of the shop.

The brushholders are re-installed, and the frame is given resistance and high potential tests, after which it is ready for assembly.

Frames which require reboring of suspension bearing housings or other machine work are returned to the manufacturer for attention. However, minor work such as building up worn nose supports, etc., is performed at Atlanta.

Armature Overhaul

The armature is carefully inspected after disassembly of the motor for loose wire bands, loose coils or wedges, condition of string bands and for signs of any unusual condition such as indications of overheating, etc. It is then placed in the degreaser for a period of approximately 15 minutes. Dust and loose scale are removed by wire brushes and blowing with compressed air. Hypot and resistance tests are then made, and if the armature is found to be satisfactory, it is moved to the vacuum impregnator and held under 30 in. of vacuum for approximately 30 min. Varnish is allowed to flow from the storage tank into the impregnating tank and when the proper level is reached, the valve is closed and carbon dioxide gas is used to apply a pressure of 30 p.s.i. for a period of 30 min. This insures penetration of the varnish into any cracks or crevices in the insulation and tightens armature coils and slot wedges. The varnish is forced back into the storage tank and a final vacuum maintained for a few minutes to evaporate the solvent. After impregnating the armature is placed in an electrically-heated, forced- circulation bake oven where is is baked at a temperature of 150 deg. C. for a period of 20 hr.

An engine lathe is used for turning the commutator, using a tool post grinder for final finish. It is proposed to provide a commutator seasoning stand for checking and grinding commutators as well as seasoning them when necessary. String bands, risers and V-ring are inspected, cleaned and painted with several coats of red insulating varnish to secure a smooth surface and eliminate any possibility of flashovers.

The armature is placed in a Gisholt Dynetric balancing machine and carefully balanced to a high degree of accuracy, after which it is sprayed with a coat of air drying varnish. A bar to bar test is made on the commutator. Both ends of the armature shaft are Magnaflux tested and the armature is ready for assembly with the frame.

Armature coil ends are cut in a lathe prior to stripping

Assembly of Traction Motor

Assembly work is started by applying the bearing caps on both ends of the shaft and, after preheating the oil thrower and inner race, shrinking them in proper position on the shaft. The outer bearing races, rollers, gaskets and covers are then applied to complete the armature sub-assembly.

With the frame on a stand in a vertical position, the armature is lowered into place and the pinion-end housing pulled down by means of cap screws. The motor is then turned to a horizontal position, and both bearing housings are drawn into place. The bearing cap is removed again from the commutator end, and dial indicator checks of runout of inner race face, internal bearing clearance, etc., are made and recorded. Assembly of bearing covers, bearing retainers, oil rings, etc., are completed, after which the pinion end bearing cover is removed and further clearance checks made and recorded.

The terminals of the motor are connected to a motor generator set, which supplies d.c. energy at 70 volts. It is then run light for a period of approximately eight hr. and checked at frequent intervals for bearing noises, temperature rise or any other unusual conditions. If the motor is found satisfactory, the pinion is heated in an induction heater and applied to the shaft, after which the motor is ready for shipment.

Armature Rewinding

Armatures which fail in service or are found to be defective must be rewound and facilities and equipment are included in the traction motor shop for performing this work. In order that it may be done in an economical manner it is necessary to provide the shop with a number of additional machines which would not be required for basic or mileage overhaul work only.

The procedure followed is generally in accord with the manufacturer's detailed maintenance instructions, supplemented by recommendations of armature coil manufacturers. There are, however, certain practices which have been developed at Atlanta which should be of interest to representatives of other railroads, operating a rewinding shop or contemplating the construction of such a shop.

The vapor degreaser used for cleaning armatures and frames in the shop for basic overhaul, has proven to be a valuable time saver when stripping coils, wedges and insulation from armatures to be rewound. The armature is placed in the degreaser for approximately 45 min. to remove or soften the varnish on coils and core, after which it is placed in an engine lathe. A special lathe tool is used to cut through both the top and bottom coils at a point adjacent to the commutator neck and at the end of the core on the pinion end. Care is taken not to damage the insulation under the coils and cutting is continued only as long as copper turnings are observed. The armature is placed on a special stand where the oil ring, wire bands, etc., are removed, after which the coils are pulled from the slots, one at a time, using a come-along grip and a one-ton electric hoist on a jib crane. This arrangement has proven to be very satisfactory in the stripping operation.

After removal of coils, insulation, etc., the fillers and coil ends in the commutator neck are removed by heating and knocking them out with a mallet and drift.

A portable infra-red oven has been developed in the shop for heating the commutator when driving out the coil ends and fillers. The oven consists of 25 infra-red lamps arranged to form two complete circles in an enclosing case. The housing has an inside diameter of 19 in. to permit it to be placed over the commutator and the surface of the commutator, except for the risers, is covered by heavy asbestos tape or cloth during the time the oven is in place. Approximately two hours heating is required before the solder has softened enough to allow coil ends and fillers to be removed with a drift tool. The principal advantage of this arrangement is that the risers are left well tinned and it is only necessary to dress them lightly with a file.

The armature core, slots, coil supports, etc., are then thoroughly cleaned of varnish, old insulation, dirt, cement, carbon dust and copper shavings. A mixture of shellac and alcohol is applied to the entire surface to protect the armature from rust or corrosion during rewinding operations.

Specially Designed Roll Type Banding Machine

A specially designed roll type banding machine is used for applying temporary bands over the equalizers as well as over the entire armature after installation of top and bottom coils. This machine was purchased from the Electric Service Manufacturing Company, and is capable of banding armatures up to 48 in. in diameter, and up to 72 in. in length. The roll method of banding is used with the tension on the band wire maintained by a compressed air cylinder. It is possible to apply as high as 1,000 lb. tension to the wire with 100 p.s.i. air pressure. In addition to temporary bands, the lathe can also be used to apply permanent bands.

Temporary bands are re-rolled four times with the air cylinder applying a tension of 450 lb. to the band wire. The same tension is used in rerolling the bottom permanent bands. However, the top permanent bands are applied using only a tension device to maintain 400 lb.

A preheating device for armature coils has been developed in eliminating damage to the coils when they are installed in the slots. A battery of infra-red lights consisting of 13 rows of 4 lamps each, in a sheet metal asbestos insulated housing is supported approximately 2 ft. above a steel table. The coils are placed under the lamps for a short period to preheat them before they are placed in the slots.

Coil ends are brazed on an American Electric Fusion Corporation electric brazing machine designed specifically for traction motor and generator armatures. It consists of a lathe type stand to support the armature on centers, water cooled brazing heads supported in proper position with integral brazing transformer and control. Installation of this unit reduced the time and labor required as compared to previous hand tong brazing. Furthermore, more uniform results are secured.

This is the second of three articles by Mr. Herman on electrical repair work at the Southern's Pegram (Atlanta, Ga.) Shops. The third, and final installment, dealing with the records kept relating to repairs, and miscellaneous repair operations, will appear in a subsequent issue.

* * *

Correction Notice

In the Consulting Department of the April 1951 issue, under Car Electrical Equipment Questions and Answers, the first line of the fourth paragraph of the answer was omitted. The first sentence of the paragraph should read: "The use of a generator regulator with a bias coil makes it possible for a railroad to select a genemotor having an a.c. motor of the proper capacity."

Fig. 1—Parts and assemblies of spring wheels and jigs for removing and applying springs

Replacing Springs on Roll-Out Carriage Wheels

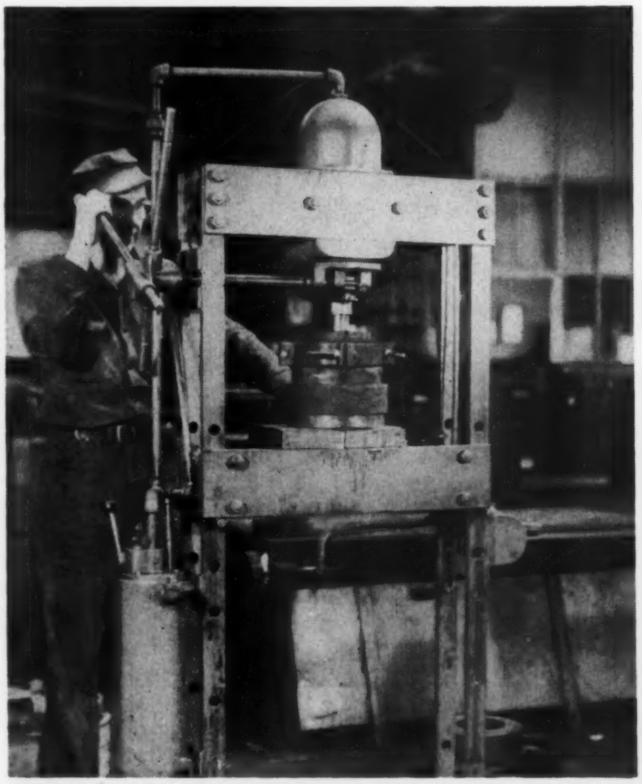


Fig. 2—The hand press used to remove and apply springs

WAUKESHA Ice Engine units for passenger-car air conditioning are mounted under the car on roll-out carriages to facilitate inspection and replacement. The four spring rollers on which the units are supported are wheels each having five coil springs which function as spokes.

It is necessary at times to replace broken springs. A method for doing this has been developed in the Paducah, Ky., shops of the Illinois Central, which makes this difficult job easy, and which completely avoids injury to the operator which might be caused by a flying spring.

The springs are held in place by five cork-shaped rubber plugs secured to the hub, and five secured to the rim of the wheel. These rubber inserts fit the inner diameter of the springs. The rubber plugs have threaded metal inserts by means of which they are secured. When they are all in place, the plugs in the rim of the wheel are fastened in place by means of cap screws inserted through the holes in the rim, and screwed into the metal inserts in the rubber.

Parts and assemblies of the wheels and jigs for removing and applying springs are shown in Fig. 1. The hand press on which the work is done is shown in Fig. 2.

To remove a set of springs, the set screws in the rim of the wheel which hold the outer five rubber plugs are removed. Then the wheel is placed on a jig on the bed of the press as shown in Fig. 3. The jig is recessed to allow the wheel to rest on a shoulder inside the jig ring or cylinder. A disk, slightly smaller than the inside diameter of the rim, is placed over the hub and springs. Pressure from the press spindle then pushes the hub and springs into the inside of the jig cylinder where they cannot fly and where they lie as loose parts free of tension or compression.

To insert springs in a wheel, the five springs are fitted over the five rubber plugs on the hub and secured by a three-part ring which is shown at the left in Fig. 1. When the three bolts in this ring are drawn up, the springs are compressed slightly more than they are when in the wheel. A wheel rim is then placed into the recess of the jig, and

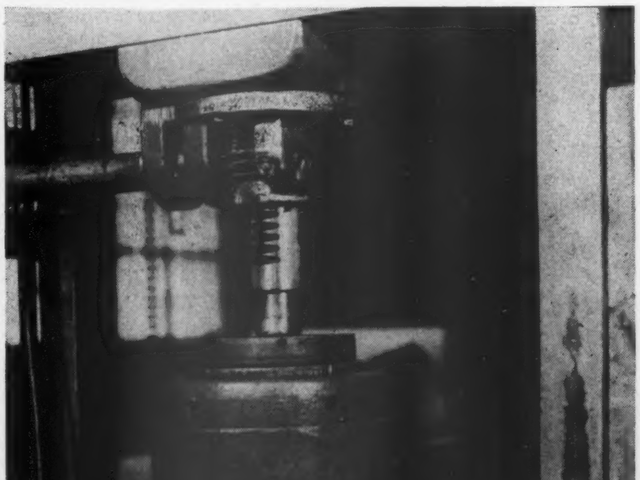


Fig. 3—A set of springs is being pushed of a wheel rim into the jig at the bottom

the hub and springs in the three-part ring placed over it as shown in Fig. 4. Pressure from the press applied through a disk is then used to push the hub and springs down into the wheel rim.

Final alignment of the springs is accomplished as shown in Fig. 5. A piece of shafting is pushed through the hole in the hub and supported on the press bed on two end supports. Pressure on top of the wheel rim removes the compression on the spring at the bottom so that the holes in the rim and the plug insert can be aligned. Then when the caps screws are applied, the wheel is ready for service. This method of removing and applying springs was developed by R. C. Flood.

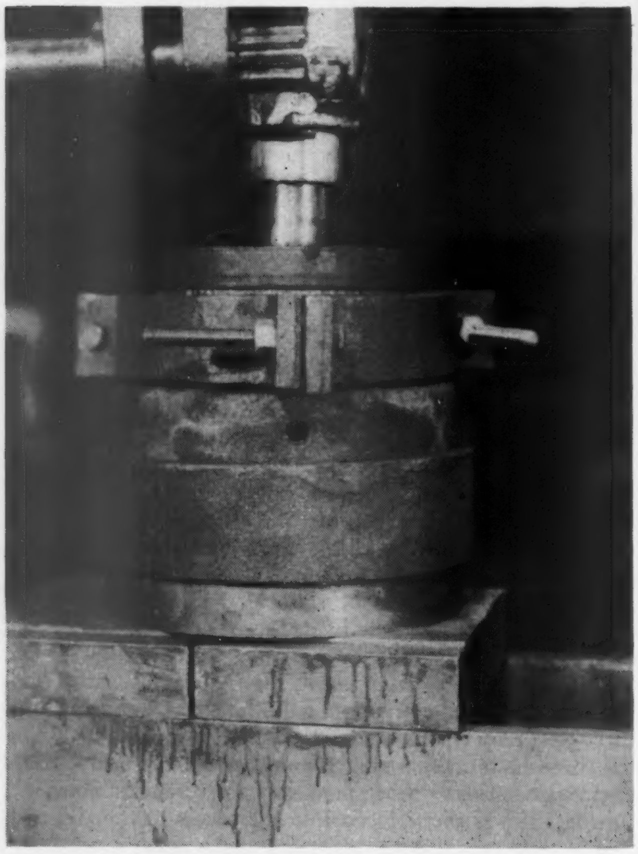


Fig. 4—The springs have been compressed by the three-part ring at the top and are being pushed down into a wheel rim which rests in a recess in the jig at the bottom

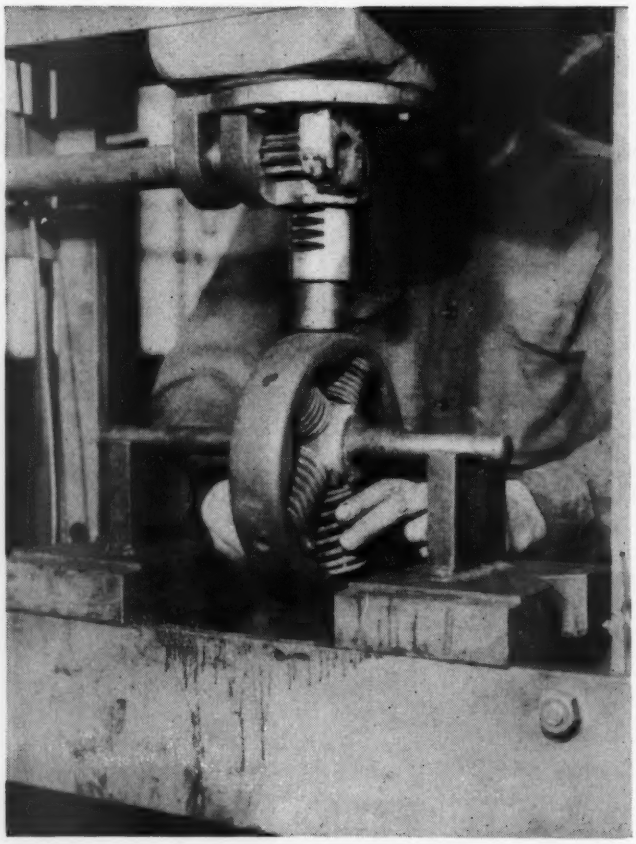
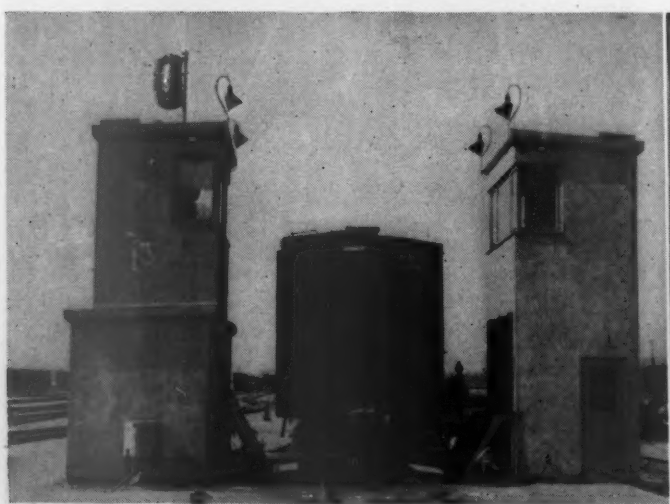


Fig. 5—Aligning a set of springs to match the holes in the retainer plugs to the cap screw holes in the wheel rim

* * *



Left: Observation towers built and equipped by the Southern Pacific at Los Angeles for inspecting freight cars entering the classification yards. The upstairs lookouts check the car roofs while the trucks and underframe are inspected with the mirror arrangement at the lower level. Right: Good lighting and properly located mirrors make truck inspection easy and complete

CONSULTING DEPARTMENT

Employee Morale

Proper maintenance of diesels requires facilities, material and skilled men interested in the work. How can morale be made an active factor in the diesel shop?

The Building Blocks of Morale

Morale in the diesel shop is a very important factor. However, it is an established fact that high morale, with resultant high efficiency, cannot be fully realized unless discipline is maintained. It is also an established fact that diesel foremen and diesel supervisors must lead their men; not drive them, as was often the case during early railroading days.

No factors are more important in building the morale of the workmen, improving shop conditions, increasing output and keeping crews happy in general, than the following Discipline, capable supervisors, knowledge and education, cooperation and responsibility.

Discipline.—Discipline is within the immediate scope of the diesel foremen and diesel supervisors. In the event a workman makes a major mistake, or violates established rules, prompt disciplinary action should be taken in order that the morale of the entire shop not be endangered. By the same token, if it should be necessary for a diesel foreman or diesel supervisor to take disciplinary action, he should be supported by higher officials, if the action is justified.

Capable Foremen and Supervisors.—These men should, of course, be competent in their particular assignments and should be able to lead their men and help them in their efforts to do their jobs efficiently. A mistake should be called to a workman's attention in such a manner that he will not feel he is being reprimanded, but in such a manner that he realizes the supervisor or foreman knows the mistake was not purposely made, and that the supervisor or foreman is there to show him the correct way of doing the job and to help him avoid making that mistake a second time.

Knowledge and Education.—Diesel foremen and diesel supervisors should, through the medium of company bulletins and periodicals, keep the men informed, (to a point prescribed by company officials), on developments and/or improvements contemplated, which will result in better working conditions. Too often it has been found that the "sand house" has been working full time concerning rumors of "big things" in the making, and the actual facts are obscured.

Cooperation.—Diesel foremen and diesel supervisors should be encouraged to lend heeding ears to suggestions made by men in the shops. A man's interest in his work can be dampened and his morale lowered if he is convinced that his suggestions appear to be worthless in the eyes of his superior officers. In many instances these suggestions are worthwhile and bear consideration. Cooperation between the workmen and their foremen and supervisors will bring these suggestions to light, and the morale of the workmen should be higher.

Responsibility. It should be impressed on all workmen that their jobs are their particular responsibilities, and that they are equally as important as any other jobs in the diesel shop. They should be made to realize that their particular jobs, no matter how small, are integral parts of the whole job of repairing and maintaining diesel locomotives. No man, in whatever capacity, can be expected to produce "extra effort" unless he is assured that his superior officers are aware of his effort, and appreciate it.

While I firmly believe that morale in the diesel shop is, generally speaking, high, I believe too, it can be improved. This will, of course, result in efficiency, increased output and contented, satisfied crews.

H. C. Taylor
Diesel Superintendent
Southern Railway System

Diesel-Electric Locomotive Batteries

Questions and Answers

Q.—If a cell voltage was fairly close to the other cell readings and the specific gravity low, what would you say was the cause?

A.—Loss of electrolyte due to overflushing or leaking container.

Q.—How do you arrive at 74 volts for the regulator setting?

A.—A standard value cannot be given as this depends on conditions. As a starting point, 74 to 75 volts is usually used for a 32-cell battery. A careful check of the specific gravity will enable you to determine whether the voltage regulator is correct, too high or too low. Excessive water consumption is an indication of too high a charge rate and the voltage setting should be reduced. Dropping off of specific gravity is an indication of insufficient charge and the voltage regulator setting should be increased. However, it is recommended that the voltage setting be changed no more than ½ volt at a time.

Q.—Why should the engine be running when making voltage readings?

A.—Unless the engine is running at the time voltage readings are being taken. there is no current going through the battery, resulting in open circuit voltage readings, as pointed out in a previous question.

Q.—Should the regulator be set at a higher value for winter than summer?

A.—This depends entirely on the operation. In extremely cold climates, it may be necessary to use a higher voltage setting in winter than in summer.

Q.—Should an equalizing charge be given a battery?

A.—An equalizing charge is not necessary if proper voltage regulator setting has been established.

Q.—How much difference in gravity would indicate that a battery needs equalizing or not?

A.—Any variation between cells of 20 points or more in specific gravity is an indication that the battery might need an equalizing charge. This might be due to too low a voltage regulator setting over an extended period of

A bench discharge will determine the actual capacity of a battery

time, which will result in a sulphated battery and considerable variation in specific gravity.

Q.—Is the finish rate on the name plate the right rate for equalizing?

A.—Yes. Although a lower rate may be used if sufficient time is available.

Q.—If a battery is very low, is it allowable to start with a charge higher than starting rate on name plate, and if so, how much higher?

A.—Yes. A higher starting charge rate may be used. A rate 2½ times that of the starting rate on a name plate may be used, provided that when gassing of the cells begins, the rate is lowered to the normal finishing rate.

Q.—Should the ammeter in cab show a charge when running?

A.—Yes. The ammeter reading will be high immediately after starting the engine, but will drop off sharply after the engine has been running a short time.

Q.—Should there be any difference between battery voltage at the battery switch and at the regulator?

A.—There will be some difference between battery voltage at the battery switch and the regulator, and this is usually due to the resistance in the circuit.

Q.—Is it safe to use an electric welder to charge a battery, regardless of the d.c. voltage of the welder if the amperes can be controlled?

A.—An electric welder can be used to charge a battery, provided caution is used in controlling the rate of charge.

Q.—What shall I use as a guide for correct regulator setting?

A.—A standard value cannot be given as this depends on the working schedule of the locomotive and atmospheric conditions. As a starting point 74 to 75 volts is usually used for a 32-cell battery. A careful check of the specific gravity will enable you to determine whether the voltage regulator is correct, too high or too low. Excessive water consumption is an indication of too high a charge rate, and the voltage setting should be reduced. Dropping off of specific gravity is an indication of insufficient charge and the voltage regulator setting should be increased. However, it is recommended that the regulator setting be changed no more than ½ volts at a time.

Q.—How should the regulators be checked?

A.—Voltage regulators should be checked with the engine r.p.m. at idling and running speeds. Make sure that the engine r.p.m. is within the limits specified by the manufacturer. The best time to check a voltage regulator is when the coils become hot to the touch, about two or three hours after the engine has been running.

Q.—If during an emergency the battery is discharged a half or more, should it be brought back to fully charged condition from an external source or let the auxiliary generator bring it back up?

A.—Let the auxiliary generator bring it back to full charge.

Q.—Before a regulator setting is changed, should a check be made to see if any irregular operations occurred to cause a temporary drop in gravity?

A.—Yes. Due to any difficulty with other parts of the locomotive, it may become necessary to start and restart the locomotive many times which will result in discharge to the battery.

Q.—What do we do if the battery becomes discharged in service due to faulty regulator or charging equipment?

A.—If the battery becomes discharged to such a low value that it will not start the diesel, it is imperative that an outside source of charge be obtained. If the regulator has been faulty over a long period of time, it is recommended that the battery be "shopped" and a prolonged equalizing charge be given to make sure that all cells are returned to a good healthy condition.

K. A. VAUGHAN
Gould Storage Battery Corporation

EDITORIALS

Failures of Truck Side Frames

Present railroad records of miles per hot box in freight as well as passenger service do not look too bad on paper and yet are subject to constant challenge, primarily because possible serious consequences make even a single hot box one too many. Similarly, truck side frames and bolsters occupy, along with wheels, axles and journals, a spot of pre-eminent importance in relation to safety. Hence, the goal sought must always be perfection in all practices pertaining to side frame inspection and maintenance.

One of the difficulties recently re-emphasized in a circular letter from the A.A.R. Mechanical Division is the possibility of cracks developing in these important steel castings and remaining undetected on account of being covered up with one or more coats of heavy paint. There is nothing new about this trouble which is thoroughly covered by Interchange Rule 3, Par. (t) (3-e), as follows: "New or secondhand truck sides and truck bolsters must not be painted with heavy asphaltic, tar or cement base paints: However, such parts may be coated with light bodied paint that will not prevent detection of flaws or cracks in ordinary inspection. Car wheels must not be painted. Note.—Existing truck sides and bolsters painted with heavy base paint, or having accumulation of rust scale, must have such paint and scale removed when cars receive general repairs."

Evidence that these instructions are not being strictly adhered to will be afforded by close scrutiny of cars in any freight yard, and a specific example of costly failure, occurring not long ago, has brought the subject into the limelight again. In this particular instance, the car involved had recently been repaired and all truck sides painted contrary to the rule. An old fracture in one side frame, located in the bottom member 5¾ in. from the journal box and amounting to 50 per cent of the cross section area, was not detected; the truck side failed under shocks and stresses incident to regular train operation; cars were derailed with attendant serious damage to lading and equipment.

Of course all truck side failures are not due to the painting over of defects. In another instance, a worn spring seat reduced the cross section area to such an extent that a sudden increase in shock load or stress caused a clean break in the metal which was entirely unpainted. In this case, the inspector who saw the car last simply overlooked the worn condition of the side frame just as other inspectors sometimes fail to appreciate the importance of the regulation against painting.

The point may be made that even one light coat of a fairly-liquid paint has some tendency to cover up defects, but unless protection is afforded to steel truck sides, especially in outdoor storage, corrosion will set in and not only in itself make the detection of defects somewhat difficult, but actually reduce stress resisting cross-section areas. No general objection, therefore, is made to the use of light-body paint as specified in Rule 3. What really does the damage, potentially if not in fact, is the application of heavy lead paints to railroad car trucks and asphalt-base paints such as are often used on refrigerator car trucks to prevent corrosion from brine drippings. While this is a highly-desirable objective, some other solution of the problem should obviously be sought and the regulation against heavy painting of truck sides and bolsters more carefully policed both by railroads and private car owners, the latter of whom are said to be particular offenders.

Keep 'Em Rolling

Beginning with the July, 1951, issue, the *Railway Mechanical and Electrical Engineer* will run a series of articles called "Diesel-Elecertics—How To Keep 'Em Rolling." They will cover the fundamentals of design, operation and maintenance, and will deal largely with electrical equipment. But, since most things electrical are largely mechanical, and since so much of a diesel is partly electrical, the scope of the articles will include nearly everything but the engine.

It is the electrical equipment on a diesel-electric locomotive which is least understood and the subject matter of these articles is so prepared that it will be of interest not only to the mechanical and electrical men in the shops, but also to the operating men, the supervisors, and in fact, nearly everyone on the railroad.

Supervisors find that the best men are frequently responsible for some kinds of trouble which are not caused by those with a lower I.Q. The reason for this is that they want to know why they are given certain instructions. Accordingly, they try things which have not been made clear to them. The why, as well as the how, is included in these articles.

Builders conduct training courses for railroad men who want to learn about the diesel. They afford the best available means of learning a lot about them, fast. Unfortunately, the great majority of railroad men cannot get away from their work to attend these courses, and those who can, must limit the time they can give to them. Railroads have their own courses of instruction. The series of articles should serve effectively to supplement the work done by the schools, and will provide a permanent record for reference. No one can long remember all the things he has learned, particularly if the teaching

has been concentrated over a short period of time. The articles on file will serve as a reference to those who have taken courses. They will also extend the needed information to the great bulk of men who do not have the opportunity to attend schools.

If you are a subscriber, plan to save your copies. If you have friends, who you think would like to know about the series, tell them.

Better Cars Is Good Business

Properly maintaining and equipping a freight car has as its ultimate objective the making of the maximum profit for its owner as well as for other roads over which it operates. As profit is the difference between income and outgo, it is as dependent on the former being large as it is on the latter being minimized. This being true, the role of equipping and maintaining cars in the best manner is a function of the car department no less important than keeping the cost of running the department to a minimum.

Cars properly equipped and maintained accomplish two essential objectives—gaining traffic and reducing damage. Yet the car department may have difficulty getting the extra money to assure this condition because it will quite often increase rather than decrease the cost of operating this department. While the savings to the railroad from reducing damage claims can be very large and very real, and the value of the additional business to be gained can be substantial, it may be difficult to correlate the benefits with the costs as one department stands the charges while others reap the benefits.

The problem of how far to go in better equipping and maintaining cars is further complicated by the owner getting only part of the benefits from the better cars, and the same is true of the money spent for test and development work in providing better cars for the shippers. Despite these and other complications that arise in carrying out a program to provide cars that will give improved service, every effort should be expended to do just that for both present and future need. It is necessary now with the high volume of traffic to reduce damage claims and delays to loaded cars en route. It will be still more necessary in the future to do all possible to gain and retain traffic when highly competitive conditions return. Car men can render their roads a real service by always being alert to all means of giving the shipper a better car, and by pointing out how expenditures for providing these better cars is money well spent.

NEW BOOKS

THE BEHAVIOR OF ENGINEERING METALS. *By H. W. Gillett, Battelle Memorial Institute. Published by John Wiley & Sons, 440 Fourth avenue, New York 16. 395 pages, 6 in. by 9½ in., cloth bound. Price, $6.50.*

The material in this book, presented from the viewpoint of the metallurgist for those who have not specialized in the field, is intended to help in choosing suitable engineering materials. The behavior of these materials is discussed, rather than the sometimes abstruse theories that seek to explain their behavior. Technical terms have been used as little as possible and, where a choice existed, references have been selected for easy reading as well as for technical content. The terms in the first six chapters, which discuss the basic concepts of metallurgy, are introduced in natural sequence, and examples show how they are used. The next nine chapters deal with the behavior of each of the principal commercial metals and alloys. The remaining chapters, discuss machinability, special fabricating techniques, means of using or selecting metals so as to combat the effects of corrosion, wear, and high temperature, and other special considerations that may influence the selection of metals and alloys. Alternate Materials, Cost, Conservation, codes are taken up in the closing chapter.

OXYGEN CUTTING. *By George V. Slottman, director of research and engineering, and Edward H. Roper, assistant technical sales manager, Air Reduction Sales Company. Published by McGraw-Hill Book Company, New York. 395 pages, 6 in. by 9 in., cloth bound. Price, $6.50.*

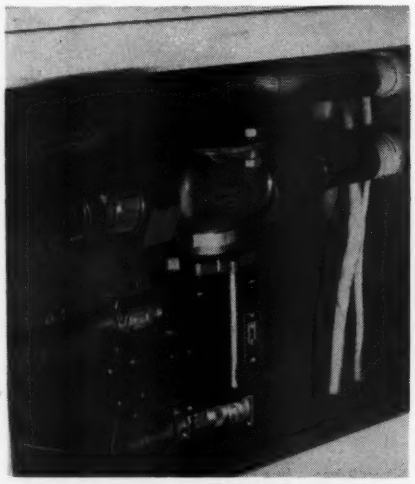
This book has been assembled with the aim of providing sufficient technical and historical background to stimulate interest in the advancement of oxygen cutting. Much of its information has been drawn from the literature and from the practical experience and research work of the authors and their associates. It is arranged in quick reference form and presents a detailed picture of oxygen cutting, the equipment and techniques used in the process, and varied applications of the process, both old and new. Flame machining, flame scarfing, underwater cutting, rock drilling, electronic tracers for cutting machines, and developments in heavy cutting are among the recent advances in the field which the book covers. Special chapters are devoted to metal temperature, plant facilities, hand and machine cutting, types of cutting machines, multiple and stack cutting, etc. The book summarizes the action of the jet and the cutting process for the practical operator and the research worker.

NEW DEVICES

Simplified Heating System

A simplified heating system has recently been installed in a coach modernized by Union Pacific. Known as the Economy system, controls for the installation are the products of the Minneapolis-Honeywell Regulator Company, Minneapolis, Minn. This approach to the railroad passenger car heating problem is an attempt to give controlled, over-all comfort throughout the car with a minimum of piping and controls.

Heating units consist of conventional finned pipes running the length of each side of the car through which a smaller steam tube is installed. A return pipe is connected to this heat exchanger making a closed hot water circulating system. Steam is introduced into the inner steam tube, and electrically driven pumps on each side of the car circulate the water. Actually, a non-freezing solution is used instead of water. When parked on standby steam service, the circulators do not operate but temperature control is maintained by a self-operated valve in the steam line that requires no electrical power.



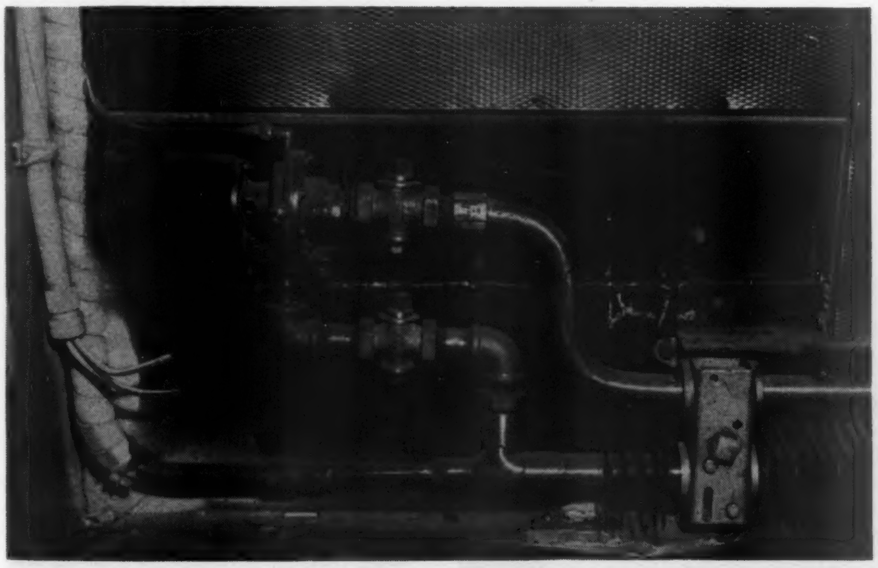
Motorized steam metering valve

Within the air-conditioning system, an overhead steam heat coil is installed to temper the incoming air and provide for air circulation throughout the coach.

Three thermostats are used in the car for temperature control, one car thermostat, a fresh air thermostat and a discharge air thermostat. These thermostats work as a team, registering in an electronic relay to control the operation of the single motorized valve which meters the steam to the car's heating system. Through this valve, the steam is controlled to the floor heat radiation units and also to the overhead coil in the air conditioning system.

This single motor-operated valve takes the place of three previously used in car heating designs of this type. It modulates the flow of steam in order to correct gradually for temperature variations and gives more even heating comfort, according to the manufacturer. As an integral part of this same valve, end switches also control the air conditioning for cooling the car.

Piping under the car has been reduced and simplified with this new system which takes less installation time and should ease maintenance and inspection. Layout, design and installation has been done by Union Pacific forces with Minneapolis-Honeywell furnishing the thermostats, motorized valve and the steam reducing valve.



Radiation unit showing anti-freeze circulating pump

The newly-modernized coach is the last of a series of 70 to go through the company's car shops in a program which began a few months ago. The car is now in service where the new heating system will be under close observation and have a chance to show how it functions under widely-varying load and temperature conditions.

Mechanical Rail Flange Lubricator

A lubricator has been designed and constructed to put a small amount of graphited grease where it will properly lubricate the flange, but will not get on the wheel tread or rail top. This action is accomplished by a gear-driven roller-chain that runs through a reservoir of graphited grease which is mixed by rotating agitators.

A small amount of graphited grease is carried by the roller-chain and deposited on the wheel flange. The chain after leaving the reservoir, is guided to the flange and protected from the weather by an applicator that is hinged at the top to follow the lateral movement of the wheel.

This mechanical rail flange lubricator is manufactured by the Rail Flange Lubricator Co., Portland 10, Ore. It is a ruggedly built, self-contained complete unit that mounts on the spring saddle of steam locomotives and the journal housing on diesels.

On logging roads equipped with the lubricators, friction drag has been reduced without loss of power due to slippage, making it possible to pull much heavier loads than was possible prior to the installation of Burrell Lubricators on the locomotives.

According to the manufacturer, the lubricators are designed and constructed to withstand engine vibration and road shock, yet function with a minimum of service. The large grease container is easily filled with a grease gun in a few minutes, and the reservoir holds enough grease for a run of 300 to 500 miles. They can be easily installed on all types of diesel and steam locomotives.

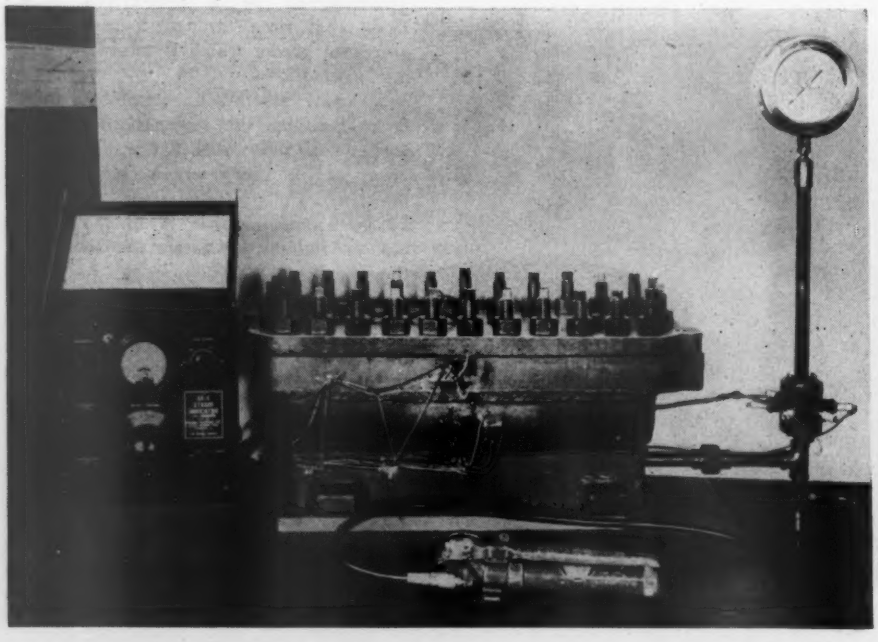
Strain Gage Tests Steam Chest

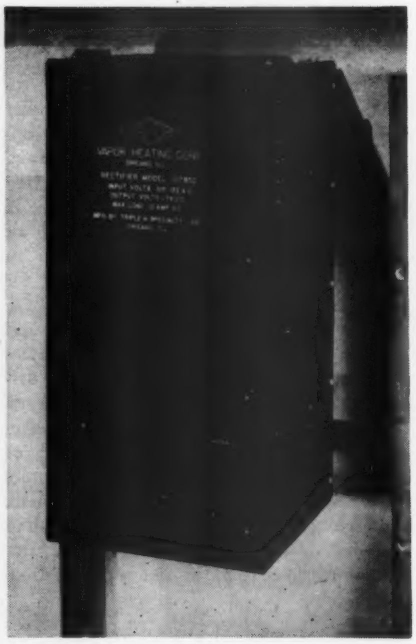
Design of this steam chest fabricated by the General Electric Co., was based to a large extent on resistance wire strain gage measurements on the walls, cover and bolts. Type SR-4 gages developed by the Baldwin-Lima-Hamilton Corp., Eddystone, Pa., were bonded to the interior and exterior walls at 14 points and to the center of the cover. Four additional gages were bonded 90 deg. apart on each of two studs in the centerline of the long sides and cover so as to give axial strains and stresses.

Leads from internal gages were taken through piping used in applying hydraulic pressure to the chest, to a manifold having six automobile spark plugs fitted to it. Lead wires were soldered to the center electrodes on the inside and connections were made to the outer terminals.

Strains were measured when the pressure in the chest had been raised to 1,200 lb. per sq. in., double normal operating pressure. The system was filled with SAE-10 oil and the pump was used to produce the desired pressure. A 21-point transfer switch was used with the Baldwin strain indicator to speed up the testing and calculating program.

Results of the tests were the basis for a decision to build steam chests with curved walls whenever practical and to fasten the cover to the flanges by studs located inside the centerline of the walls where they join the flange. The gages showed further that stud bending moments may be excessive unless nuts and bolts are carefully produced to as to keep nuts parallel to the cover.





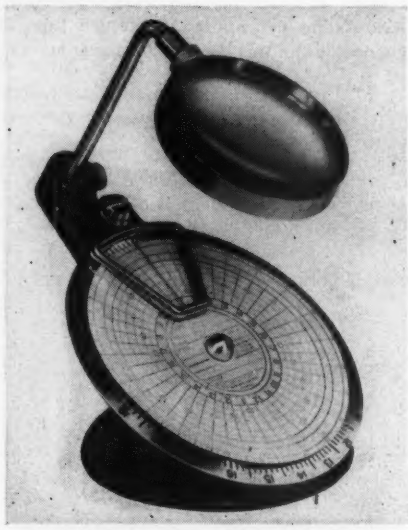
Charger for Locomotive Batteries

A selenium rectifier has been developed by the Vapor Heating Corporation, Chicago, in cooperation with the Triple A Specialty Company, Chicago, to convert 110- and 220-volt a.c. power to 74-volt a.c. to operate Vapor hot water heaters on freight and switcher diesel locomotives and railroad passenger cars during overnight standby periods.

The rectifier supplies 12 amp. for sustained periods to operate the hot water heater motor which drives the blower and fuel pump and supplies a trickle-charge current to the storage batteries, to keep the batteries from freezing, and to maintain them at high efficiency. The trickle-charge rate is controlled by a standard type incandescent lamp, making it easy to increase the charging rate by using a higher wattage lamp.

The overall dimensions of the rectifier are 20 in. high, 10 in. wide and 10 in. deep, including the wall mounting brackets.

Mr. Kittredge was born in Sharon, Pa., and is a graduate of Cornell University (in 1939). He served as a naval officer during World War II, joining National Malleable at Indianapolis, Ind., in 1946. He was transferred to the Railway division at Cleveland, Ohio, as assistant sales manager.



Switch Engine, Recorder Chart Analyzer

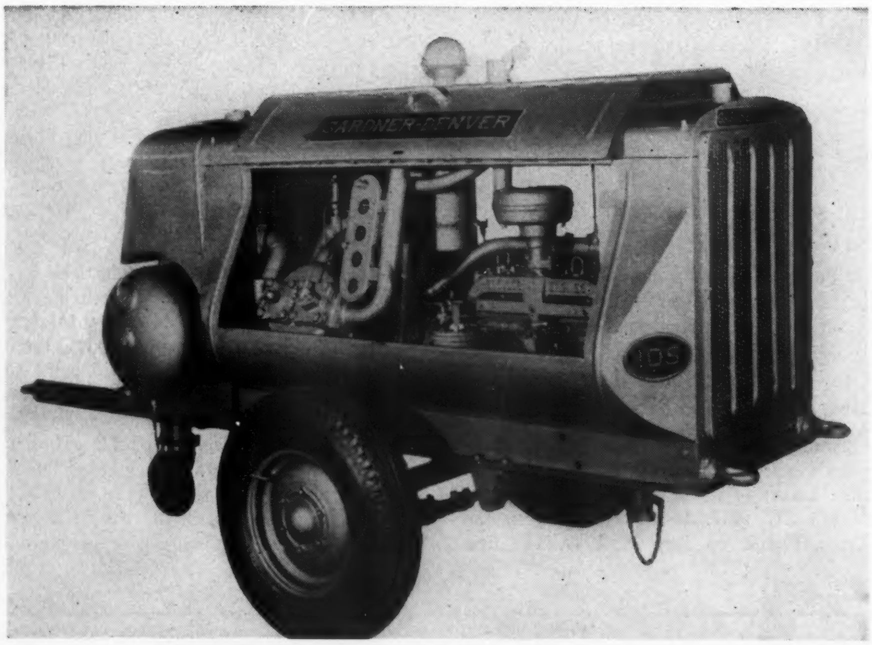
A chart analyzer has been developed for use in reading and analyzing the Barco switch engine recorder charts. It was designed for increasing the efficiency of railroad switching operations.

Records made by the device includes idle time, operating time, number of miles traveled and speed during an eight hour period.

The apparatus, made available by the Barco Mfg. Co., Chicago 40, Ill., consists of a convenient, circular, revolving plate with hair line indicator and reading glass which facilitates the reading of charts and listing of data on a simple report form.

Two Stage Air Compressor

Recently introduced to the trade by the Gardner-Denver Co., Quincy, Ill., is a two stage, portable air compressor, model WH-105 powered by a Hercules QXD-5 gasoline



engine. This engine, built by Hercules Motors Corp., Canton, Ohio, is a 6 cylinder unit with a $3\frac{7}{16}$ in. bore and $4\frac{1}{8}$ in. stroke. The piston displacement is 230 cu. in.

The gasoline engine is equipped with an oversized, gear driven oil pump which provides pressure lubrication to all main, connecting rod and idler gear bearings. A cooling system is provided by full length water jackets around all cylinders and by a positive gear driven water pump. This pump is designed to eliminate misalignment and undue wear on vital parts.

The compressor provides the user with an all water cooled 105 cu. ft. per min. unit which assures cooler air to the tools and thus keeps tool upkeep to a minimum. Being a two-stage air compressor, it assures adequate rated capacity at any altitude. Air is compressed to 28 lb. in the first stage, cooled back to almost atmospheric temperature in a radiator-type intercooler, and boosted to final discharge pressure in the second stage. An unloader pilot operates the suction unloading valves within a fixed range and automatically throttles the engine to idling speed and unloads the compressor.

This compressor is furnished on two or four wheeled spring mounted running gears and also on wood skids for truck mounting.

Diesel Fueling Alarm Signal

The Ventalarm signal developed by the Scully Signal Co., Cambridge 41, Mass., audibly indicates its presence on the tank at the start of the fill. For installation on diesel locomotives, on their fuel tanks, it provides attendants with a positive fueling guide.

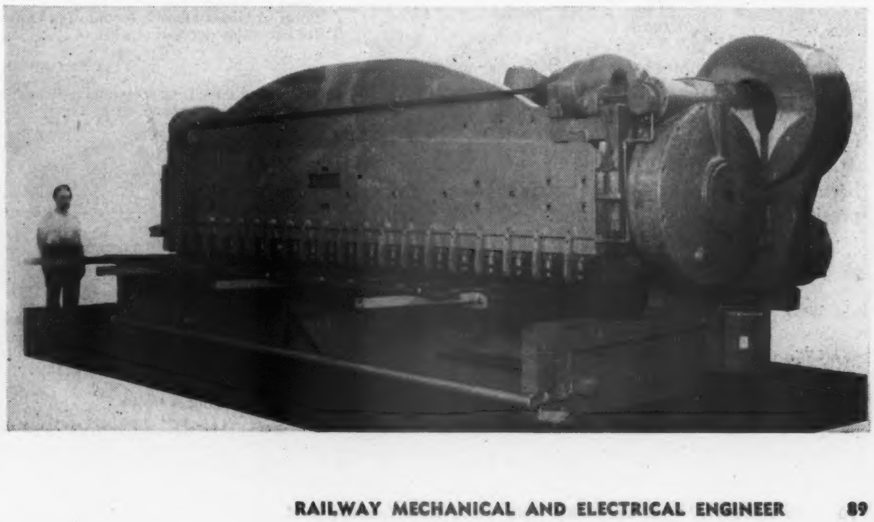
When fueling starts, the venting vapors forced out of the tank by the incoming liquid blows a sensitive whistle incorporated into the signal assembly. The whistle sounds continuously until the rising liquid seals the signal intrusion tube. This tube projects into the tank at a predetermined distance. When the whistle stops, the attendant simply stops filling.

The unit offers many advantages including elimination of dangerous, wasteful and messy overflow spillage during fueling. It permits faster servicing and makes it possible to fuel at faster pump rates without loss of time in topping-off operations. Night filling is simplified as the mental strain on the filling attendant is relieved.

The whistle in the alarm signal operates at a pressure of 0.5 oz. per sq. in. On sealing of the intrusion, either in the Standard or Remote types, there is no decrease in adequate venting area. Further vapor venting bypasses the intrusion and the whistle.

All Steel Squaring Shear

A shear with a capacity of 20 ft. of $\frac{1}{2}$ in. mild steel plate is the latest addition to the line of All-Steel Squaring Shears manufactured by The Cincinnati Shaper Co., Cincinnati 25, Ohio.



This device, weighing over 135,000 lb. has a speed of 20 strokes per min. It is equipped with hydraulic hold-downs capable of exerting a holding force of over 70 tons. The hold-down pistons are made with automobile type piston rings for long life and have a unique vacuum pump arrangement that prevents leakage of hydraulic oil. It has a 24 in. throat or gap and a 48 in. back gage range

Standard equipment includes four edge high carbon tool steel knives with straight sides and a section measuring $1\frac{3}{4}$ x $6\frac{1}{2}$ in. ball bearing back gage with graduated dials, automatic lubrication, hinged angle and complete guarding.

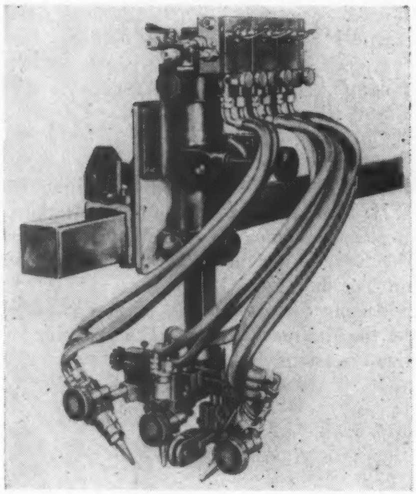


Plate-Edge Preparation Device

The Airco plate-edge preparation device which employs a spring-balanced, free floating carriage and caster-wheel assembly to permit bevel cutting over plate undulations while maintaining a constant tip-to-work distance, may be mounted on any gas cutting machine equipped with a 3-in. square torch bar.

This device manufactured by the Air Reduction Sales Co., New York 17, N. Y., has been designed to increase production and insure accurate preparation of plate

(Continued on page 122)

NEWS

Ontario Section Host at A.S.M.E. Semi-Annual Meeting

THE Royal York Hotel, Toronto, Ont., will be the headquarters for the semi-annual meeting of the American Society of Mechanical Engineers June 11-14. The Engineering Institute of Canada will cosponsor several sessions. The American Rocket Society and the Institute of Aeronautical Sciences will also participate in the meeting. More than 80 papers will be presented in 38 technical sessions. The Right Honorable C. D. Howe, Canadian Minister of the Department of Defense Production, will address the banquet of the Society on Wednesday evening, June 13. C. J. MacKenzie, chairman of the National Research Council in Canada, will deliver the Roy V. Wright Lecture at a luncheon on Tuesday, June 12.

Among the sessions are three sponsored by the Railroad Division. The program for these sessions is as follows.

WEDNESDAY, JUNE 13
2:30 p.m. DST
Railroad I—Fuels III

Air Pollution and Smoke Abatement, Owen R. Barefoot, superintendent motive power and car department, Canadian Pacific.

Symposium on Performance Experienced with Double-Screened Locomotive Fuels. To be participated in by

E. C. Payne, consulting engineer, Pittsburgh Consolidation Coal Co.
J. W. Swan, fuel conservation engineer, Louisville & Nashville
W. O. Cottingham, supervisor locomotive performance, Western Maryland
H. G. Pike, superintendent equipment, Pittsburgh & Lake Erie
R. M. Pilcher, assistant engineer of tests, Norfolk & Western

THURSDAY, JUNE 14
9:30 a.m. DST
Railroad II

Recent Developments in Oil-Burning on Steam Locomotives, W. A. Vanderland, research engineer, Department of Research, Canadian Pacific.

Development Potentialities of the Alberta Oil Fields, Dr. O. B. Hopkins, vice-president, Imperial Oil Limited.

THURSDAY, JUNE 14
2 p.m. DST
Railroad III

Development of the Opposed Piston Diesel Engine, George A. Mueller, general sales manager, Canadian Locomotive Company.

"Power to Stop," a motion picture on the braking of passenger cars produced by American Steel Foundries.

Gas Turbine Electric Locomotive Has Handled 363,816 m.g.t.m.

Operation of the General Electric Company's gas-turbine-electric locomotive on the Union Pacific was terminated on March 31, 1951. It was shipped to the Union Pacific on July 28, 1949. The first few weeks were spent on a tour, and actual operation in freight service was begun August 22, 1949. From this date to March 31, 1951, the locomotive operated a total of 94,885 miles, produced 344,950 m.g.t.m. of service and burned 1,448,787 gal. of fuel, of which about 95 per cent was bunker C oil. This is an average of 4.2 gal. per m.g.t.m. and an average weight of train of 3,635 tons.

Since November 1, 1948, which is the approximate date the locomotive was placed

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

FREIGHT SERVICE (DATA FROM I.C.C. M-211 AND M-240)

Item No.		Month of January 1951	1950
3	Road locomotive miles (000) (M-211):		
3–05	Total, steam	28,876	27,397
3–06	Total, Diesel-electric	20,921	15,201
3–07	Total, electric	838	765
3–04	Total, locomotive-miles	50,635	43,364
4	Car-miles (000,000) (M-211):		
4–03	Loaded, total	1,749	1,370
4–06	Empty, total	852	794
6	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):		
6–01	Total in coal-burning steam locomotive trains	48,863	40,985
6–02	Total in oil-burning steam locomotive trains	11,727	10,268
6–03	Total in Diesel-electric locomotive trains	57,675	41,764
6–04	Total in electric locomotive trains	2,275	1,987
6–06	Total in all trains	120,546	95,010
10	Averages per train-mile (excluding light trains) (M-211):		
10–01	Locomotive-miles (principal and helper)	1.05	1.05
10–02	Loaded freight car-miles	38.50	35.20
10–03	Empty freight car-miles	18.80	20.40
10–04	Total freight car-miles (excluding caboose)	57.30	55.60
10–05	Gross ton-miles (excluding locomotive and tender)	2,653	2,440
10–06	Net ton-miles	1,244	1,073
12	Net ton-miles per loaded car-mile (M-211)	32.30	30.50
13	Car-mile ratios (M-211):		
13–03	Per cent loaded of total freight car-miles	67.20	63.30
14	Averages per train hour (M-211):		
14–01	Train miles	16.60	17.20
14–02	Gross ton-miles (excluding locomotive and tender)	43,471	41,371
14	Car-miles per freight car day (M-240):		
14–01	Serviceable	45.50	38.90
14–02	All	43.40	36.10
15	Average net ton-miles per freight car-day (M-240)	942	697
17	Per cent of home cars of total freight cars on the line (M-240)	34.50	50.90

PASSENGER SERVICE (DATA FROM I.C.C. M-213)

Item No.		1951	1950
3	Road motive-power miles (000):		
3–05	Steam	12,584	12,376
3–06	Diesel-electric	16,001	14,120
3–07	Electric	1,715	1,662
3–04	Total	30,300	28,159
4	Passenger-train car-miles (000):		
4–08	Total in all locomotive-propelled trains	292,751	269,271
4–09	Total in coal-burning steam locomotive trains	67,727	61,803
4–10	Total in oil-burning steam locomotive trains	37,565	37,352
4–11	Total in Diesel-electric locomotive trains	169,210	151,973
12	Total car-miles per train-miles	9.58	9.35

YARD SERVICE (DATA FROM I.C.C. M-215)

Item No.		1951	1950
1	Freight yard switching locomotive-hours (000):		
1–01	Steam, coal-burning	1,447	1,422
1–02	Steam, oil-burning	259	267
1–03	Diesel-electric[1]	2,957	2,292
1–06	Total	4,692	3,967
2	Passenger yard switching hours (000):		
2–01	Steam, coal-burning	58	70
2–02	Steam, oil-burning	15	14
2–03	Diesel-electric[1]	246	229
2–06	Total	354	348
3	Hours per yard locomotive-day:		
3–01	Steam	8.50	7.20
3–02	Diesel-electric	18.10	17.30
3–05	Serviceable	14.90	13.40
3–06	All locomotives (serviceable, unserviceable and stored)	12.90	11.00
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.85	1.99
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.75	0.80

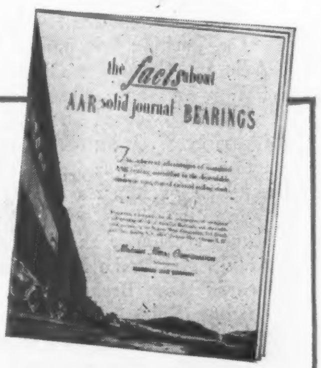
[1] Excludes B and trailing A units.

Standard AAR SOLID BEARINGS have helped to make it so!

Just as our Nation's well-being demands free interchange of rolling stock, *so must all freight car parts be freely interchangeable.* They must provide dependable all-weather performance—with quick, easy maintenance and minimum standby inventories.

The low-cost AAR solid bearing does more than that. It's unrestricted as to speed and load, light in weight, quiet running, smooth riding—yet boasts an unequalled performance record in severest railroad service.

Be sure to get your free copy of the *facts*



See why America's Railroads have standardized on Solid Bearings

HERE'S A PARTIAL LIST OF CONTENTS:

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on test in Erie, Pa., the total locomotive miles are 105,732. This includes mileage on the Pennsylvania, the Nickel Plate, and approximately 4,500 miles on the Union Pacific Tour. Since November 1, 1948, a total of 1,797,426 gal. of fuel oil have been burned. This includes some power plant testing on the water box when no locomotive mileage was produced. A total of 363,816 m.g.t.m. have been credited to the locomotive since November 1, 1948.

Mechanical Division Meets June 26-28

THE 25th annual meeting of the A.A.R. Mechanical Division will be held at the Congress Hotel, Chicago, June 26 to 28. There will be no exhibition of railway equipment and supplies in connection with this meeting. The program follows:

TUESDAY, JUNE 26

- Address by a railroad executive.
- Address by J. H. Aydelott, vice-president, Operations and Maintenance Department, A.A.R.
- Address by Chairman, Mechanical Division, B. M. Brown, general superintendent motive power, Southern Pacific Company.
- Report of General Committee.
- Report of Nominating Committee.
- Discussion of Reports on:
  - Locomotive Construction:
    - Steam and Electric Locomotives Section
    - Diesel Locomotive Section
    - Gas-Turbine Locomotive Section
  - Axle and Crank Pin Research
  - Safety Appliances

WEDNESDAY, JUNE 27

- Address by W. J. Patterson, member, Interstate Commerce Commission.
- Discussion of Reports on:
  - Arbitration
  - Prices for Labor and Materials
  - Brakes and Brake Equipment
  - Geared Hand Brakes
  - Loading Rules
  - Special Committee on Forest Products Loading
  - Specification for Materials
  - Couplers and Draft Gears
  - Lubrication of Cars and Locomotives
  - Development of Hot Box Alarm Devices
  - Progress Report—Join Committee on Railway Sanitation

THURSDAY, JUNE 28

- Discussion of Reports on:
  - Tank Cars
  - Wheels
  - Car Construction
- Election of members of General Committee and Committee on Nominations.

Locomotive Development Committee Moves to Dunkirk

THE offices of the Locomotive Development Committee, Bituminous Coal Research, Inc., have been moved from Baltimore, Md., to 320 South Roberts road, Dunkirk, N. Y. —P.O. Box 225.

John Yellott will continue as director of research and Peter R. Broadley as assistant director of research at Dunkirk.

This $5 million Baltimore & Ohio ore pier, dedicated by the road's president, Col. R. B. White, on May 15 at Curtis Bay, Baltimore, Md., can accommodate ocean-going ore carriers of up to 40,000 tons. The ore is scooped out of the ships' holds by 15-ton buckets. Smaller buckets are used for cleaning up operations. The buckets drop the ore into bins which feed it to a rubber conveyor belt, 48 in. wide and 895 ft. long. The belt has a sustained capacity of 2,000 tons per hour, and travels 400 ft. per min. It carries the ore to a scale-house where it is weighed automatically before it is deposited in waiting cars on the tracks below. Cars emptied at the adjoining coal pier are immediately available for loading with ore, thus eliminating turn-around movement. The ore pier is 650 ft. long and has two ore unloading machines on movable towers. It can be extended an additional 600 ft. and two more unloading machines erected on it.

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE MAY ISSUE

DIESEL LOCOMOTIVE ORDERS

Road	No. of units	Horse-power	Service	Builder
Atlanta & West Point	1[1]	1,200	Switch	Baldwin-Lima-Hamilton
Chesapeake & Ohio	27[2]	2,250	Passenger	Electro-Motive
	21[2]	1,200	Switch	Electro-Motive
	59[2]	1,500	Road-Switch	Electro-Motive
Chicago, Burlington & Quincy	23[3]	1,500	Road switch	Electro-Motive
Chicago, Rock Island & Pacific	25	1,500	Road switch	Electro-Motive
	15	1,500	Double-control suburban	Alco-G. E.
	5	1,600	Road switch	Alco-G. E.
Gulf, Mobile & Ohio	3[4]	1,600	Road switch	Alco-G. E.
Lake Superior & Ishpeming	3[5]	1,000	Switch	Alco-G. E.
Minneapolis & St. Louis	3[6]	1,000	Road switch	Alco-G. E.
Missouri-Illinois	1[7]	1,600	Road switch	Alco G. E.
St. Johnsbury & Lamoille County	1[8]	600	Switch	Gen. Elec.
Spokane, Portland & Seattle	3[9]	1,200	Switch	Electro-Motive
	2[9]	1,600	Road switch	Alco-G. E.
Union Pacific	30	1,500	Freight	Electro-Motive
	16	1,200	Yard switch	Electro-Motive
	6	1,600	Road switch	Baldwin-Lima-Hamilton
United States Army	41	800	Switch	Electro-Motive
United States Steel Corp	8	1,200	Switch	Baldwin-Lima-Hamilton
	8	1,200	Switch	Fairbanks, Morse
Wabash	1[10]	2,250	Passenger	Electro-Motive
	12[10]	1,500	Freight	Electro-Motive
	10[10]	1,500	Road switch	Electro-Motive
	5[10]	1,200	Switch	Electro-Motive
	4[10]	1,500	Freight	General Motors Diesel Ltd.
	1[10]	1,500	Road switch	General Motors Diesel Ltd.
	1[10]	800	Switch	General Motors Diesel Ltd.

FREIGHT CAR ORDERS

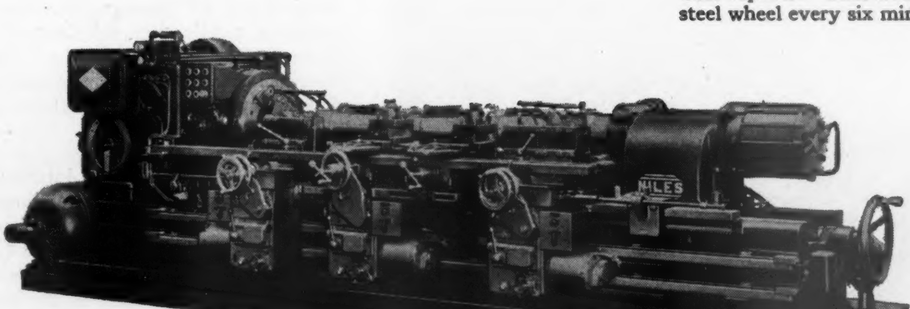
Road	No. of cars	Type of car	Builder
Canadian National	75[11]	70-ton-Hopper	National Steel Car
Clinchfield	500[12]	50-ton hopper	Pullman-Standard
Delaware & Hudson	500	50-ton box	Pullman-Standard
	500	50-ton hopper	Pullman-Standard
Detroit & Mackinac	100[13]	50-ton box	General American
Florida East Coast	75[14]	70-ton covered hopper	Pullman-Standard
Illinois Central	150[15]	70-ton hopper	General American
	100[17]	50-ton gondola	Pressed Steel Car

(Continued on page 98)

NILES Hydraulic Centering Machine. Centers new axles or renews centers on mounted or unmounted axles prior to turning. Permits easy checking of individual and related concentricity. Action is automatic. Assures high production and uniform dimensional results.

for the Railroads
for the SHOPS
TOOLS

NILES Hydraulic Diesel Wheel Borer. Speeds and feeds designed for carbide tools. Push button chucking and unchucking, automatic boring cycle. User reports: "Cast wheel every four minutes—steel wheel every six minutes."



NILES End Drive Axle Lathe. Developed after extensive research, to speed up this key operation. Machines axles over their entire length in $\frac{1}{3}$ to $\frac{1}{2}$ the time ordinarily required. Leaves no indentation from driving jaws.

LIMA-HAMILTON

OFFICES IN PRINCIPAL CITIES

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE MAY ISSUE ***(Continued from page 92)***

Minn., St. Paul & Sault Ste. Marie	350[15]	50-ton box	Company shops
	200[16]	50-ton gondola	Company shops
New York Central	1,000[17]	55-ton hopper	Pullman-Standard
	2,500[17]	55-ton hopper	Despatch Shops
	1,000[17]	55-ton box	Despatch Shops
	50[17]	12,000-gal. tank	General American
	200[17]	Cabooses	St. Louis Car
Northern Pacific	250	70-ton gondola	American Car & Fdry.
Richmond, Fredericksburg & Potomac	50[18]	70-ton gondola	General American
Union Tank Car Co.	50[19]	11,000-gal. propane tank	American Car & Fdry.
Western Fruit Express Co.	500[20]	50-ton refrigerator	Company shops

FREIGHT CAR INQUIRIES

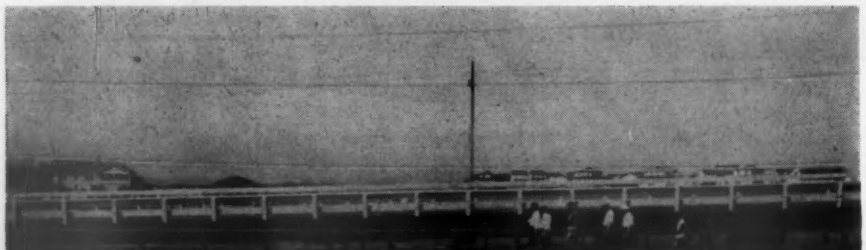
Denver & Rio Grande Western	1,000	70-ton gondola
New York, New Haven & Hartford	550	70-ton hopper
Spokane, Portland & Seattle	500	50-ton box

PASSENGER CAR ORDERS

Road	*No. of cars*	*Type of car*	*Builder*
Wabash	1	Dome-parlor-lounge	Pullman-Standard

[1] Cost, $102,500. Delivery scheduled for August.
[2] Deliveries of the passenger units scheduled to begin in July and to be completed in November; switching units scheduled for delivery in October and November, the road-switching units delivery of which will start in October and completed in May, 1952. When these units are in service, the Pere Marquette district will be 100 per cent dieselized for all services, and the Chesapeake district will be dieselized 60 per cent for switching, 80 per cent for passenger service, and 11 per cent for freight service.
[3] Delivery scheduled for later this year.
[4] Approximate cost of $426,000. Delivery scheduled for September.
[5] Cost, $348,000. Delivery scheduled for November or December.
[6] Approximate cost $342,000. Delivery scheduled for October.
[7] Delivery scheduled for October.
[8] Cost, $78,000.
[9] Two of the switching units scheduled for delivery in September and the third in October. The road-switching units are scheduled for delivery in September.
[10] Delivery scheduled for 1952.
[11] To cost over $600,000.
[12] Approximate cost of each $4,900. For delivery in June, 1952.
[13] Approximate cost, $600,000. Scheduled for fourth-quarter delivery.
[14] Approximate cost $575,000. Delivery tentatively scheduled for the second half of 1952.
[15] Delivery scheduled for the second quarter of 1952.
[16] Delivery scheduled for early 1952.
[17] Cabooses to be received late this year. Other cars to be built next year.
[18] Cost $322,000. Delivery scheduled for the fourth quarter 1951.
[19] Delivery anticipated during the first quarter of 1952.
[20] Scheduled for delivery during the first quarter of 1952.

NOTES:
Canadian National.—The Canadian National's 1951 program calls for the purchase of 5,500 box cars (including 500 for the Grand Trunk Western), 500 refrigerator cars, and 2- 3,000-hp. diesel-electric road locomotives.
Northern Pacific.—The Northern Pacific will purchase seven 1,200-hp. switching, four 1,500-hp. road switching, one 1,500-hp. "B" freight and three 1,500-hp. passenger (two "A" and one "B") units, and two four-unit 6,000-hp. freight locomotives for 1952 delivery.
Pennsylvania.—The Pennsylvania shortly will order 132 additional diesel-electric locomotives, according to Walter S. Franklin, president of the road.
Union Pacific.—The Union Pacific will purchase 16 sleeping, 14 chair, 10 baggage, 6 dining, 2 mail-baggage and 2 baggage-dormitory cars.



Part of a group of 80 railroad and railway supply engineers who attended the Railroad Corrosion Conference sponsored by the International Nickel Company, Inc., at Wrightsville Beach, N. C. May 1 to 3, 1951. The program included discussions of corrosion problems on railroads, car design to resist corrosion (see page 43), corrsion problems associated with car cleaning, protective coatings, corrosion in diesel engines and gas turbine metals.

SUPPLY TRADE NOTES

AMERICAN BRAKE SHOE COMPANY.—*Raymond H. Schaefer* has been elected a vice-president of the American Brake Shoe Company, with headquarters at Mahwah, N. J.

◆

FRANKLIN RAILWAY SUPPLY COMPANY. *M. J. Donovan*, formerly assistant to the president of the Franklin Railway Supply company, has been appointed vice president, in charge of merchandising of new products, and *William T. Lane*, formerly western sales manager, has been appointed vice-president, in charge of western sales including the company's industrial products, with headquarters at Tulsa, Okla.

◆

AIR REDUCTION COMPANY.—*J. D. Gunther* has been elected a vice-president of the Air Reduction Company. Mr. Gunther has been secretary of the company since 1946.

◆

SIMMONS-BOARDMAN PUBLISHING CORPORATION.—*C. B. Peck*, editor of the Railway Mechanical and Electrical Engineer at New York, and *Edward G. Gavin*, editor of the American Builder at Chicago, have been elected directors of Simmons-Boardman. *William H. Schmidt, Jr.*, western editor of the Railway Age at Chicago, has been elected a vice-president and a director. *William L. Taylor*, circulation manager of the American Builder, has been appointed also circulation manager of the Railway Age, the Railway Mechanical and Electrical Engineer, Railway Engineering and Maintenance, and Railway Signaling and Communications, all Simmons-Boardman transportation publications. *Robert G. Lewis*, assistant to the president of Simmons-Boardman, has been appointed also director of subscription sales, transportation papers.

◆

ALUMINUM COMPANY OF AMERICA.—*Roy A. Hunt*, president of the Aluminum Company of America since 1928, has been named chairman of the Executive Committee, and *I. W. Wilson*, senior vice-president, has been elected president of the company. *J. O. Chesley*, manager of the railroad division of the company since 1944, has retired. No immediate successor will be named.

Mr. Wilson began his career with Alcoa in 1911 at Niagara Falls, N.Y., following his graduation from Massachusetts Institute of Technology. He became general superintendent of the aluminum company's reduction plants in 1921, and was named vice-president in charge of operations in 1931. He became senior vice-president in 1949. During World War I, Mr. Wilson

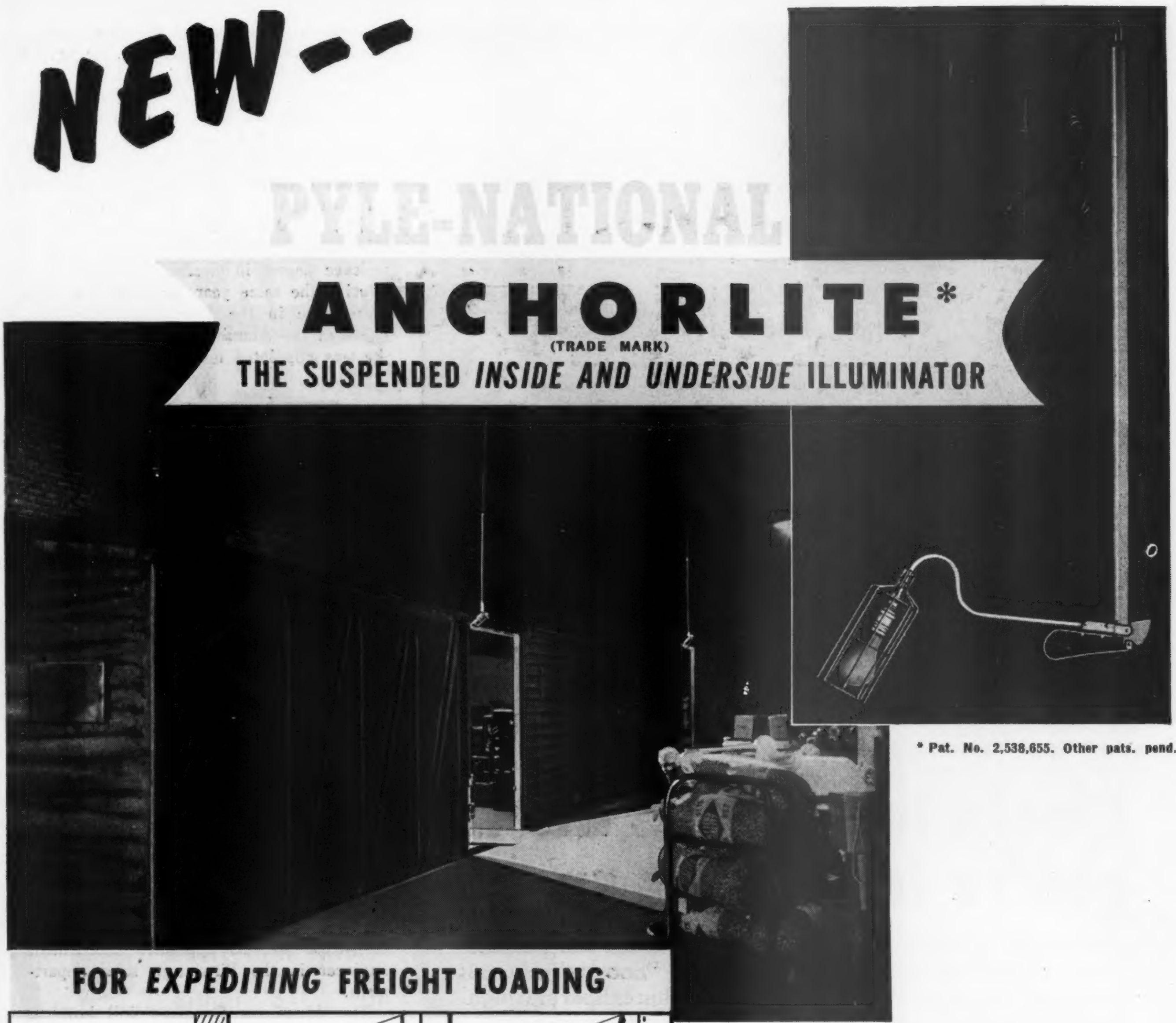
NEW--

PYLE-NATIONAL

ANCHORLITE*

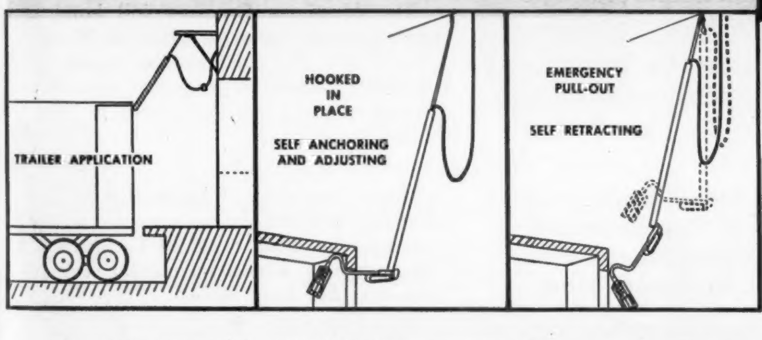
(TRADE MARK)

THE SUSPENDED *INSIDE AND UNDERSIDE* ILLUMINATOR



* Pat. No. 2,538,655. Other pats. pend.

FOR *EXPEDITING* FREIGHT LOADING



- *SAVES* MAN HOURS
- *REDUCES* MAINTENANCE AND REPLACEMENT COSTS
- *REDUCES* FIRE AND ACCIDENT HAZARDS

The Pyle-National ANCHORLITE answers the need for a convenient, economical source of the good lighting required, temporarily, *inside* freight cars, trucks and trailers while at loading platforms. It is also used to light the *underside* of equipment in locomotive and car shops and in warehouses and stock rooms for lower bin lighting.

The Pyle-Anchorlite is suspended overhead where it is out of the way yet always convenient and easy to reach when needed. In freight houses it is designed to be suspended from a messenger wire on which it can slide the full length of a loading platform bay, to any position where the freight car door may be spotted on the tracks. Spring tension anchors it in position for use without other means of holding and takes care of all variations in freight car door height.

Write for Anchorlite Bulletin

THE PYLE-NATIONAL COMPANY

1358 N. KOSTNER AVENUE · CHICAGO 51, ILLINOIS

BRANCH OFFICES AND AGENTS in principal cities of the United States and Canada. EXPORT DEPARTMENT: International Railway Supply Co., 30 Church St., New York. CANADIAN AGENT: The Holden Co., Ltd., Montreal

SINCE 1897

LOCOMOTIVE HEADLIGHTS · GYRALITES · TURBO-GENERATORS · FLOODLIGHTS · PLUGS & RECEPTACLES · MULTI-VENT AIR-DISTRIBUTION

GREAT NORTHERN FINDS:

Plastic tape's tops when you're in a tight spot!

There's no room for bulky splices in the sleek walls of the Great Northern streamliners! That's why "SCOTCH" No. 33 Electrical Tape is used by Great Northern. Thin caliper and high dielectric strength make this the ideal single tape insulation.

And this same tape can do many jobs better for you. It's abrasion-resistant to withstand vibration, stretchy and smooth for neat harnesses, and it's unaffected by water, oil, sunlight. Sticks at a touch, too!

Order "SCOTCH" No. 33 Electrical Tape today from your jobber. Now available in "Job Size" ¾ in. x 20 ft. rolls packed 12 in a screwtop container. For complete information write: Minnesota Mining & Mfg. Co., Dept. RM-61, St. Paul 6, Minn.

PIG-TAIL SPLICES are neater, more compact with "SCOTCH" Electrical Tape No. 33. Tape has dielectric strength of 10,000 volts, replaces two conventional tapes with only a single application. Photos show car being wired at the St. Louis plant of the American Car & Foundry Company.

The term "Scotch" and the plaid design are registered trade-marks for the more than 100 Pressure-sensitive adhesive tapes made in U.S.A. by **MINNESOTA MINING & MFG. CO.**, St. Paul 6, Minn.—also makers of "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-Slip Surfacing, "3M" Abrasives, "3M" Adhesives. General Export: Minnesota Mining & Mfg. Co., International Division, 270 Park Avenue, New York 17, N. Y. In Canada: Canadian Minnesota Mining & Mfg. Co., Ltd., London, Ont.

served in the Chemical Warfare Service, and attained the rank of Major. He headed Alcoa's $300,000,000 plant expansion program during World War II, as well as the $450,000,000 Defense Plant Corporation program carried out by Alcoa for the Government. In 1949 he received a Presidential Certificate of Merit in recognition of his contributions to the war effort.

Mr. Chesley is a graduate of Brown University (1911), with a bachelor of science degree in mechanical engineering. During the same year, he became a sales apprentice in the New Kensington, Pa., office of the Aluminum Company. In 1913 he was appointed manager of the district

J. O. Chesley

office in Detroit, and, two years later, was transferred to the Pittsburgh district sales office. He served in the United States Navy during World War I, and, when he returned to Alcoa, he was appointed mechanical engineer in the Pittsburgh sales department.

The Aluminum Company will build a new aluminum smelting plant at Wenatchee, Wash. The plant will be capable of supplying 170,000,000 pounds of aluminum annually; production is expected to begin within 15 months.

◆

READ STANDARD CORPORATION. — The *Standard Stoker Company* has changed its name to the Read Standard Corporation. No change in ownership, management or personnel has been made.

◆

ELECTRO-MOTIVE DIVISION. — A new diesel-repair parts warehouse to serve southwestern railroads has been established on Tillar street, Ft. Worth, Tex., by the Electro-Motive division of General Motors.

◆

AMERICAN WHEELABRATOR & EQUIPMENT CORP.—*Stanley F. Krzeszewski* has been elected a vice-president of American Wheelabrator. Mr. Krzeszewski will continue also as factory manager.

◆

DOUBLE SEAL RING COMPANY.—*M. A. Moore* has been appointed eastern division manufacturing and sales manager of the Double Seal Ring Company, Fort Worth, Tex. Mr. Moore, formerly sales and service representative in Maine, Vermont and

WHEN CRITICAL MATERIAL IS SCARCE—

Repair POWER CABLES with

AMP SOLDERLESS CONNECTORS

HEAVY DUTY PNEUMATIC TOOL #69015

Either "STUB" or conventional side position crimping with AMP's double-handled Pneumatic Tool. Interchangeable jaws for wire sizes #6 to #1/0.

SOLISTRAND® BUTT CONNECTORS

Can be used on solid, stranded or irregular shaped wire. These pure copper connectors make strong, vibration-proof permanent splices #22 to #4/0.

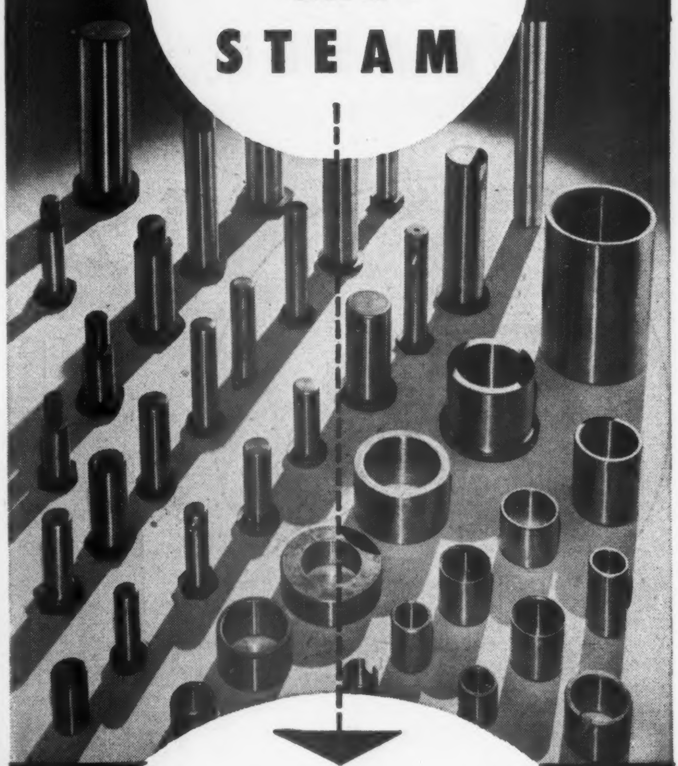
AMP

AMP TRADE MARK REG. U.S. PAT. OFF.

AIRCRAFT-MARINE PRODUCTS, INC.

2100 Paxton Street, Harrisburg, Pa.

. . . for DIESEL and STEAM



EX-CELL-O

RAILROAD PINS and BUSHINGS WEAR LONGER

Diesel equipment brings new maintenance problems to America's railroads. Ex-Cell-O's methods of manufacturing railroad pins and bushings assure uniformity in size and quality that is essential to long service. The correct heat treatment gives an extremely hard surface for wear resistance and a tough ductile core to withstand shocks and vibration. Precision grinding assures a uniformly good finish and accurate size.

XLO

EX-CELL-O for PRECISION

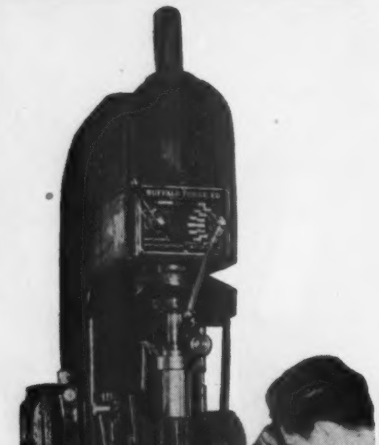
Whether your problems concern new work or maintenance on steam or Diesel equipment, it will be to your advantage to use Ex-Cell-O hardened and ground steel pins and bushings. Write today for a new catalog of standard types and sizes—ask for Bulletin No. 32381.

Railroad Division

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

The Speed You Need
– INSTANTLY
with the RPMster



No stopping the motor or other time-consuming adjustment — you select the proper speed for the job by moving a lever. The "Buffalo" RPMster's unique variable speed drive does the rest. Hundreds of these big 99"-high precision drills are saving money on both job and production work up to 1½" capacity in cast iron. BULLETIN 3257 has the specifications. LET US MAIL YOU A COPY.

BUFFALO "Buffalo" FORGE COMPANY
174 Mortimer St. Buffalo, New York
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING PUNCHING CUTTING SHEARING BENDING

New Hampshire, will maintain new headquarters at New Rochelle, N. Y. Before joining Double Seal, Mr. Moore was a supervisor of diesel engine sales and service at Houston, Tex., for General Motors Corporation.

◆

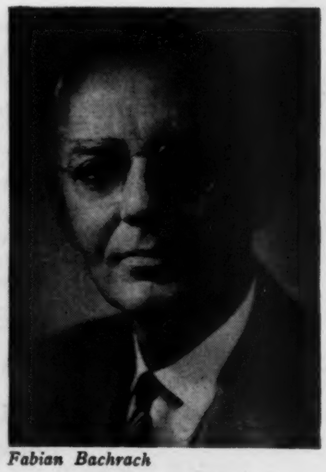
Eaton Manufacturing Company.—*R. B. Little* has been appointed general sales manager of the Reliance division of the Eaton Manufacturing Company.

Mr. Little attended the Republic Steel sales school, Massillon, Ohio, in 1932 and subsequently worked for five years as a member of the sales department in the New York office. In 1939 he joined the Moltrup Steel Products Company, Beaver Falls, Pa., as sales manager in charge of the New York district territory. He joined Eaton as a sales representative in the Reliance division's New York sales office.

R. B. Little

◆

Black & Decker Mfg. Co.—*Alonzo G. Decker*, a cofounder of Black & Decker, has been elected president to succeed S. Duncan Black, deceased. *Robert D. Black*, vice-president in charge of sales, has been elected vice-president, and *Glen H. Treslar*, vice-president and sales manager, has been elected vice-president in charge of sales.



Fabian Bachrach

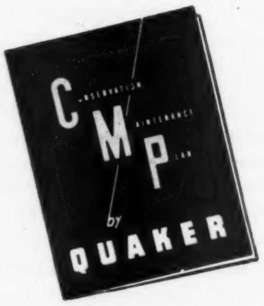
A. G. Decker

Mr. Decker, who has been vice-president and general manager of the company since he and S. Duncan Black started the company in 1910, began to work at the age of 15 in a brass foundry as an apprentice

LESS SLIP . . . LESS NOISE . . . LESS MAINTENANCE

QUAKER V-BELTS

Built to Harness Railway Industry's Horsepower!



FOR MORE PRODUCTION . . . GET THIS BOOK

. . . and the entire QUAKER Conservation Maintenance Plan — includes maintenance memos, wall chart, factual data to help you reduce maintenance. No charge . . . no obligation.

Year after year at work on railway equipment and in countless applications Quaker V-Belts continue to pile up records for low cost performance.

That's because Quaker V-Belts are built to:

- Deliver power more efficiently.
- Eliminate slippage and vibration.
- Require less maintenance and adjustment.
- Withstand punishment.

Quaker's technical skill, research and developments are behind the extra efficiency and stamina of Quaker V-Belts. Longer-than-average wear of these belts results from a construction of specially compounded materials . . . husky, pre-stretched cords . . . tough, rugged covers.

The work-horse ability of Quaker V-Belts characterizes all of Quaker's pre-tested, performance proved products. *That is why you should specify Quaker Industrial Rubber Products.* Write for the new Quaker Catalog—#651-RM.

QUAKER RUBBER CORPORATION
DIVISION OF H. K. PORTER COMPANY, INC.

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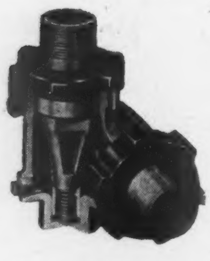
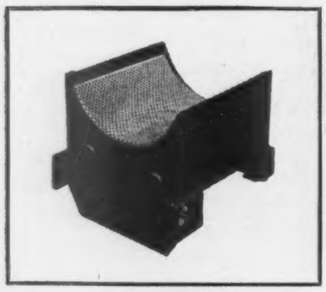
PHILADELPHIA 24, PENNA. BRANCHES IN PRINCIPAL CITIES

use Franklin parts on Franklin devices

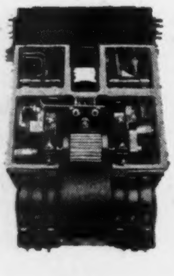


Sleeve Joints

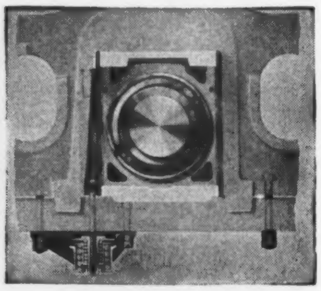
In order to obtain full efficiency from your Franklin devices, specify genuine Franklin parts in replacement. Franklin devices will always perform best when equipped with genuine Franklin parts made to interchangeable tolerances and of the correct materials.



Driving Box Lubricators

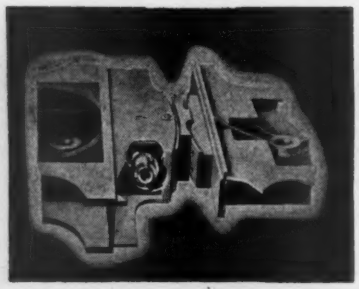


The Locomotive Booster



Automatic Compensators & Snubbers

Franklin System of Steam Distribution



Radial Buffers

Fire Doors

Power Reverse Gears

FRANKLIN RAILWAY SUPPLY COMPANY

A CORPORATION

NEW YORK • CHICAGO • TULSA • MONTREAL

STEAM DISTRIBUTION SYSTEM • BOOSTER • RADIAL BUFFER • COMPENSATOR AND SNUBBER
POWER REVERSE GEARS • FIRE DOORS • DRIVING BOX LUBRICATORS • OVERFIRE JETS
JOURNAL BOXES • FLEXIBLE JOINTS • TANK-CAR VALVE

RAILWAY DISTRIBUTOR FOR N.A. STRAND FLEXIBLE SHAFT EQUIPMENT

moulder. He later worked in a pattern shop and, finally, in the shop of the National Composotype Company where he advanced to the engineering department. In 1906 he joined the engineering department of the Rowland Telegraphic Company. Four years later he and Mr. Black went into business together making special machinery to order.

◆

PEERLESS EQUIPMENT COMPANY. — *Norman T. Olsen* has been elected vice-president of the Peerless Equipment Company.

◆

GENERAL ELECTRIC COMPANY.—*Arthur H. Morey,* project engineer of the Locomotive and Car Equipment divisions of the General Electric Company, recently was awarded a Charles A. Coffin award, the company's highest honor, for his "vision, ingenuity, and perseverance in designing, developing and testing the first gas turbine electric locomotive to be built in the United States."

◆

ELECTRIC STORAGE BATTERY COMPANY.—The Electric Storage Battery Company has announced plans for a new three-story building, 52 ft. wide by 421 ft. long, at Crescentville, Philadelphia, Pa., for its engineering department. The building, of steel, brick and concrete, will provide 40,000 sq. ft. of working area and will house a museum of Exide products; a new technical library, and laboratories with the research equipment for spectrographic, photomicrographic and X-Ray diffraction stud-

◆

UNION ASBESTOS & RUBBER CO. The Union Asbestos & Rubber Co. has acquired the business of *Dromgold & Glenn,* Chicago, suppliers of refrigeration equipment for refrigerator cars, trucks and tailers. Henceforth the business will be operated as the *Dromgold & Glenn Division* of Union Asbestos & Rubber, under the direction of *W. H. Fehrs,* vice-president of the latter company.

◆

FAIRBANKS, MORSE & CO.—A new sales and service office has been completed by Fairbanks, Morse at 3000 West 117th street, Cleveland, Ohio. The new structure, with an area of about 30,000 sq. ft., includes the Cleveland branch office, a modern diesel repair shop, completely equipped scale shop for repairing and rebuilding scales, a large warehouse, and repair parts department and display floor.

◆

UNION CARBIDE & CARBON CORP.—*Dr. George O. Curme, Jr.,* has been elected vice-president in charge of research of the Union Carbide & Carbon, Corp. Dr. Curme, who has been vice-president in charge of chemical research for the corporation, will now head all of the research activities of Union Carbide.

◆

STANDARD CAR TRUCK COMPANY.—*Dan Call* has been appointed sales agent for the Standard Car Truck Company, with headquarters at Richmond, Va.

Frank Nugent has been appointed sales

a 10-year record of improved values

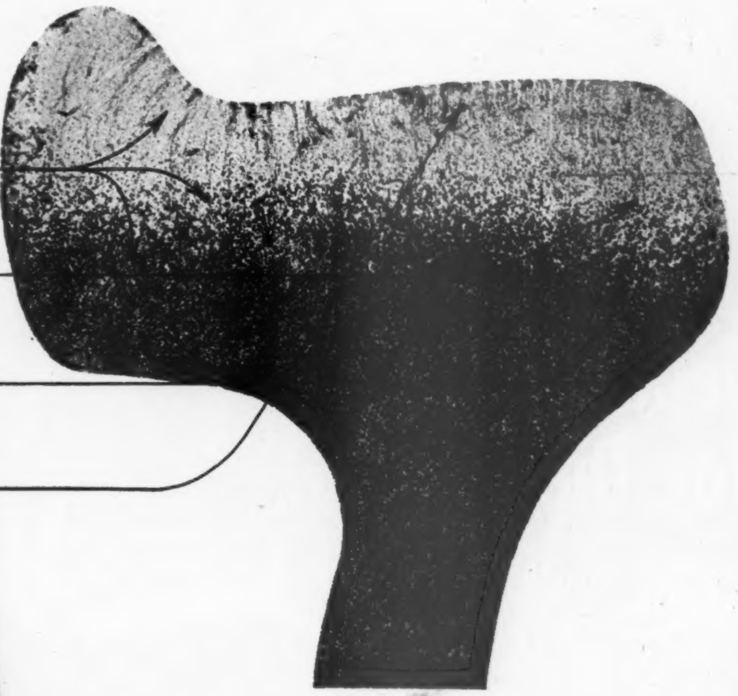
1941-1946 Improved Control of mottled iron formation, providing clearer chill at tread and more impact resistant gray iron backing.

1945 AMCCW plants adopt limitation on chill depth in rim.

1945 Rim thickness increased.

1947 More rigid inspection and standards for rotundity adopted for wheels shipped from AMCCW plants.

1950 New wheel design features heavier tread (stronger flange and rim) and more brackets (thicker, heavier, more continuous flange support).



INSIDE STORY...

of the AMCCW chilled car wheel

The 10-year record of improved values gives you the inside story of why AMCCW wheels are making better safety records . . . 120,000,000 car miles in 1950 without failure.

(And the new AMCCW design with its 100% increase in rim strength and 20% increase in flange strength is just beginning to roll.)

The record shows why chilled car wheel performance has improved so continuously, over the years.

For more information about the advantages of AMCCW wheels, write for the booklet: GENTLEMEN OF THE JURY.

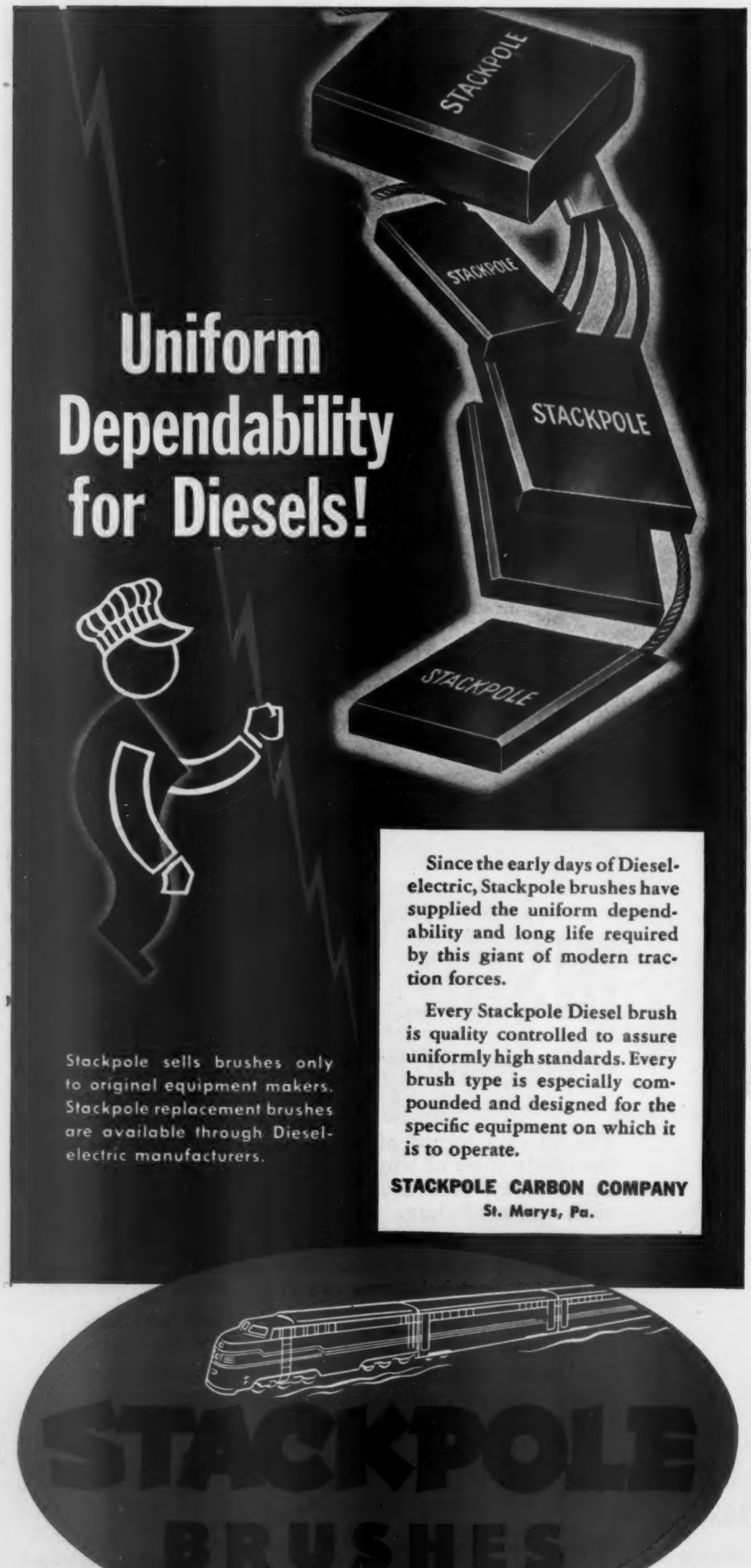
AMCCW

- Low first cost
- Low exchange rates
- Reduced inventory
- Short haul delivery
- Increased ton mileage
- High safety standards
- Complete AMCCW inspection
- Easier shop handling

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

445 North Sacramento Boulevard, Chicago 12, Ill.

American Car & Foundry Co. • Southern Wheel (American Brake Shoe Co.)
Griffin Wheel Co. • Marshall Car Wheel & Foundry Co. • New York Car Wheel Co.
Pullman-Standard Car Mfg. Co.



agent, with headquarters at St. Paul, Minn. Mr. Call was formerly associated with the Richmond, Fredericksburg & Potomac for 20 years and was general foreman of the locomotive department when he left that road in 1948 to enter private business.

◆

TIMKEN ROLLER BEARING COMPANY.—*Paul Reeves*, formerly advertising manager of the Timken Roller Bearing Company, has been appointed director of sales.

Mr. Reeves joined Timken in 1929 and, after completing his engineering training course, worked as sales engineer in the Chicago office. He subsequently was transferred to the San Francisco, Cal., branch office where he was appointed industrial district manager. In 1940 he was appointed sales promotion manager, with headquarters at Canton, Ohio, and during World War II was in charge of handling contracts between the company and the government. Mr. Reeves was appointed advertising manager in 1943.

◆

SPRING PACKING CORPORATION.—*John B. Welch* and *W. Huntley McPhee* have been appointed assistant vice-presidents and *Carl A. Schroeder* and *Lee C. Van Hooser* regional managers of the Spring Packing Corporation, with headquarters at New York and Los Angeles, Cal., respectively.

◆

SCULLIN STEEL COMPANY. — *Fred H. Spenner*, formerly vice-president in charge of mechanical engineering of the Scullin Steel Company, St. Louis, Mo., has been appointed vice-president and executive assistant to the president.

◆

BALDWIN-LIMA-HAMILTON CORPORATION. —*Thomas F. Kearney*, formerly diesel service supervisor for Baldwin-Lima-Hamilton at Chicago, has been appointed transportation sales representative for the Chicago district. *James M. Barnhill* succeeds Mr. Kearney as diesel service supervisor.

Obituary

S. DUNCAN BLACK, president of the Black & Decker Mfg. Co., died suddenly on April 15 of a cerebral hemorrhage in Bal-

Fabian Bachrach

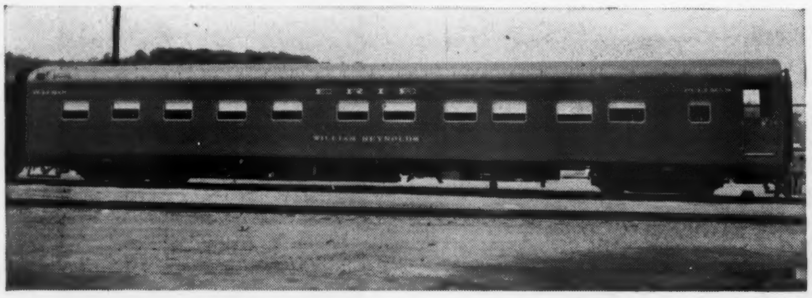
S. D. Black

ERIE service hits new high at 100-year mark with help of TIMKEN® bearings

1. THE YEARS leading up to the Erie Railroad's 100th Anniversary, now being celebrated, have been marked by continuous progress—resulting in constantly better service for Erie shippers and passengers.

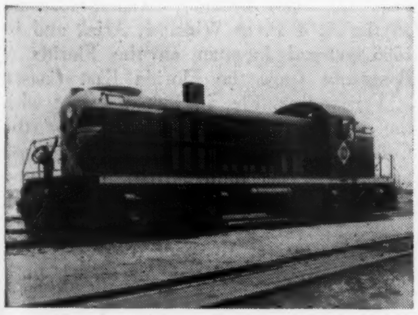
2. IMPORTANT STEP in Erie progress has been the use of Timken® tapered roller bearings on many types of Erie equipment. The Erie's new Alco passenger diesels on the Cleveland-Pittsburgh run are Timken bearing equipped.

3. ERIE DINING CARS, too, roll on Timken tapered roller bearings. Passengers like the smooth, jolt-free rides that Timken roller bearings make possible; Erie operating people like the low maintenance costs.

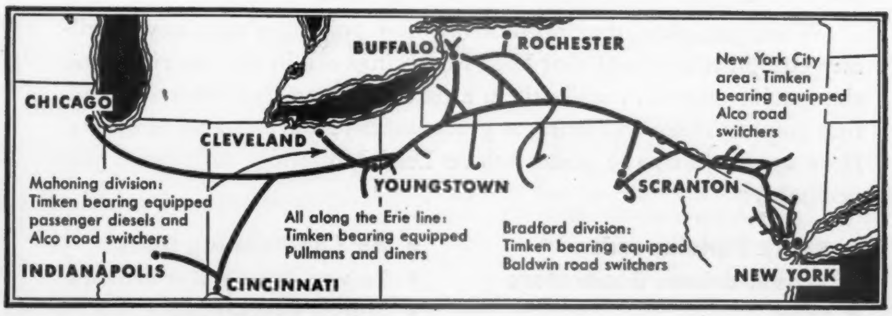


4. DELUXE IN EVERY WAY, the Erie Railroad's luxurious new "President" series of pullmans is Timken bearing equipped, insuring maximum riding comfort.

5. SPEEDING FREIGHT on the Bradford Division, Erie's Baldwin road switchers roll on Timken bearings.



6. THE ERIE'S Alco road switchers are also on Timken bearings, eliminating the possibility of delays due to bearing trouble.



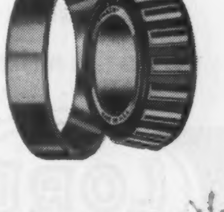
7. THE ERIE SERVES the six great states of New York, New Jersey, Pennsylvania, Ohio, Indiana and Illinois—the Heart of Industrial America. Throughout the Erie system (see map above), Timken tapered roller bearings are helping the Erie set ever-higher standards in transportation service.

More steam locomotives, passenger cars, and freight cars roll on Timken bearings than on any other make of anti-friction bearings. Let us help you with your bearing applications. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL ◯ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ⊂▭ BEARING TAKES RADIAL AND THRUST — LOADS OR ANY COMBINATION

Lord Mountings cushion road shock, reduce noise, protect the smooth functioning of equipment, reduce maintenance costs, add to the comfort and satisfaction of the traveling public.

When you plan new locomotives, new passenger cars, new auxiliary equipment be sure that Lord Mountings are in the drawings and the specifications . . . make them a part of design. No other expenditure you can make will bring as great returns from so small an outlay. Here are some of the places where Lord Mountings will serve you profitably:

- **Relay Panelboards**
- **Wheel-driven Generators**
- **Fans**
- **Vestibule Diaphragms**
- **Air Conditioning Units**
- **Power-driven Generators**
- **Signal Equipment**
- **Communication Equipment**

Write for your copy of the Lord Natural Frequency Chart and of the Vibration Isolation Chart. Designers and engineers will find them of definite value.

Although defense production is putting a heavy demand on our facilities, LORD will make every effort to supply industrial needs.

LORD MANUFACTURING COMPANY • ERIE, PA.

Canadian Representative, Railway & Power Engineering Corp. Ltd.

LORD BONDED RUBBER

Vibration-Control Mountings . . . Bonded-Rubber Parts

timore, Md. Cofounder of the firm with Alonzo G. Decker 40 years ago, Mr. Black had continued as the active head of the company until his death. He was 67 years old.

FRANK P. ROESCH, retired vice-president of the Standard Stoker Company, died at his home in Chicago on April 28 at the age of 87. Mr. Roesch was born in Alsace-Lorraine, on April 14, 1864. He attended grammar and high schools and in 1877 became a machinist apprentice on the Chicago, Rock Island & Pacific at Trenton, Mo. In 1881 he became a machinist in the employ of the South Park Railway (now the Colorado & Southern) at Denver, Colo. and in 1883, enginehouse foreman at Gunnison, Colo. From later in the same year through part of 1884 he was, successively, boomer machinist, locomotive fireman and locomotive engineer with the Denver & Rio Grande (now the Denver & Rio Grande Western), the Southern Pacific and the Atlantic & Pacific (now the Atchison, Topeka & Santa


F. P. Roesch

Fe). He then became division foreman on the A. & P. at Winslow, Ariz., and in 1885 general foreman on the Florida & Peninsula (now the Florida East Coast) at Fernandina, Fla. In 1886 he went with the Denver & New Orleans (now the Colorado & Southern) as enginehouse foreman at Denver. In 1887 he became locomotive engineer; in 1891, traveling engineer; in 1892, locomotive engineer; in 1899, general traveling engineer, and in 1901, master mechanic of the C. & S. In 1902 he was appointed master mechanic of the Chicago & Alton (now the Gulf, Mobile & Ohio), and in 1904, general manager of the Hicks Locomotive & Car Works, Chicago. In 1906 he became master mechanic of the Southern, serving successively at Birmingham, Ala., and Spencer, N.C. He was master mechanic of the El Paso & Southwestern (now the Southern Pacific) at Douglas, Ariz., from 1908 until 1918, when he was appointed regional fuel supervisor, Northwest Region, United States Railroad Administration. His association with the Standard Stoker Company became in 1920 as western manager. In 1923 he was appointed general sales manager and in 1935 was elected vice-president and director. Mr. Roesch was an affiliate member of the Mechanical Division, A.A.R.; a past presi-


on cars . . . on car journals . . . NO-OX-ID will

stop rust before it starts

Losses due to corrosion, costly unnecessary repairs can ill be afforded during these critical days. To help you maintain and protect your vital equipment, Dearborn provides a complete line of NO-OX-ID rust preventives for positive protection against the constant threat of corrosion. Two examples of the effective use of NO-OX-IDs are:

1. ***ON GONDOLA CAR*** construction. Wherever there is metal-to-metal contact, NO-OX-ID Filler Red "C" prevents corrosion, greatly reduces maintenance costs.
2. ***CAR JOURNALS*** must be protected during storage, ready for use when needed. A single coat of NO-OX-ID "A Special" is all that's needed to protect them for extended periods of outdoor storage.

Let a Dearborn engineer help you develop a NO-OX-ID preventive maintenance program. He will demonstrate how proper application of the correct NO-OX-ID will stop corrosion.

Please Note Our New Address
DEARBORN CHEMICAL COMPANY
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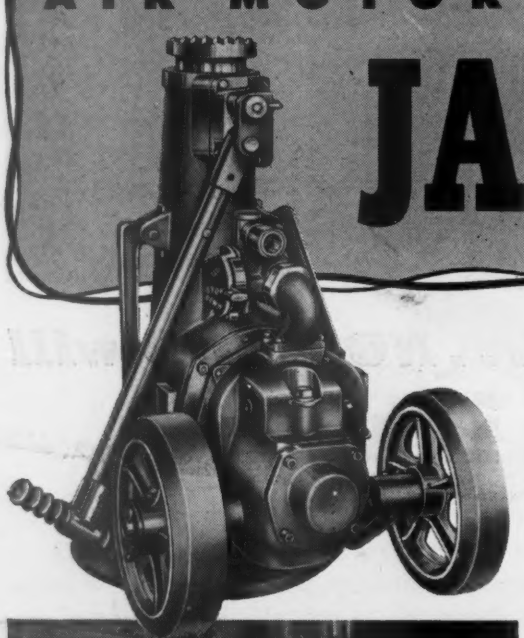

Railroad men appreciate the relief from jacking strain made possible by Duff-Norton Air Motor Power Jacks, in lifting all types of locomotives and cars for repair and maintenance work. Another thing—men are kept fresh to begin repairs as soon as heavy load is lifted, since the only effort used in the jacking operation is a flip of the finger.

These jacks are available with lifting capacities from 20 to 100 tons. They can be controlled to a fraction of an inch and are easy to spot—easy to handle. No danger of creepage or sinking under load.

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"The House that Jacks Built"

dent of the Traveling Engineers' Association, and a past president of the Railway Eqipment Supply Men's Association. He was a member of the American Society of Mechanical Engineers, the Railway Fuel & Traveling Engineers' Association, the Smoke Prevention Association and the Master Boiler Makers' Association, and was chairman of the Committee of the Coordinated Mechanical Associations.

PERSONAL MENTION

General

H. M. Hoffmeister has been appointed engineer of tests of the Missouri Pacific Lines, with headquarters at St. Louis, Mo..

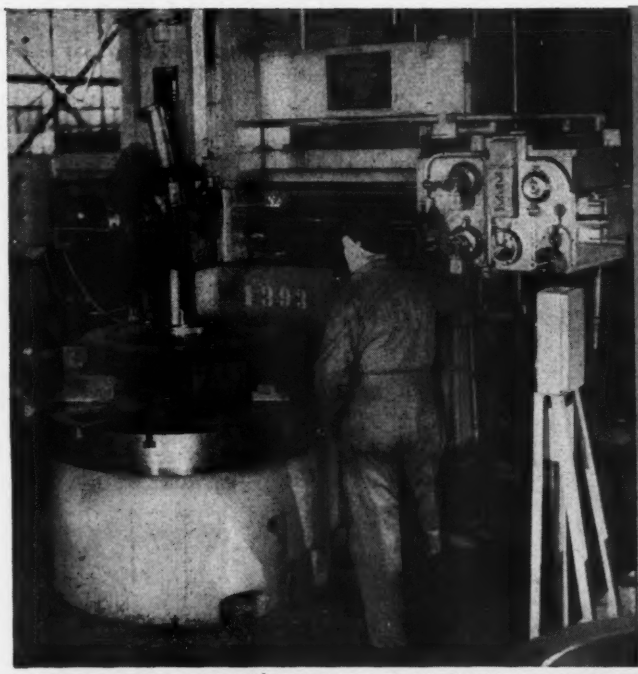
P. J. Finch has been appointed assistant to superintendent motive power—diesel engineering and maintenance, of the Chesapeake & Ohio at Richmond, Va. The position of mechanical engineer at Richmond, formerly held by Mr. Finch, has been abolished.

L. H. Kueck, assistant chief mechanical officer of the Missouri Pacific Lines, at St. Louis, Mo., has retired. Mr. Kueck was born at Sedalia, Mo., July 20, 1895, and

L. H. Kueck

entered railroad service in April, 1917, with the M. P. as a draftsman. From 1920 to 1924 he was a draftsman on the Texas & Pacific, subsequently returning to the M. P. Later he advanced through the positions of chief draftsman, assistant chief mechanical engineer and chief mechanical engineer, becoming assistant chief mechanical officer in February, 1944.

E. C. Meinholtz, engineer of tests of the Missouri Pacific Lines at St. Louis, Mo., has been appointed mechanical engineer, with headquarters at St. Louis. Mr. Meinholtz was born at St. Louis, May 14, 1904, and educated in the public schools there and at Washington University, where he received bachelor and master of science degrees in mechanical engineering. He began his career with the M. P. in the summers of



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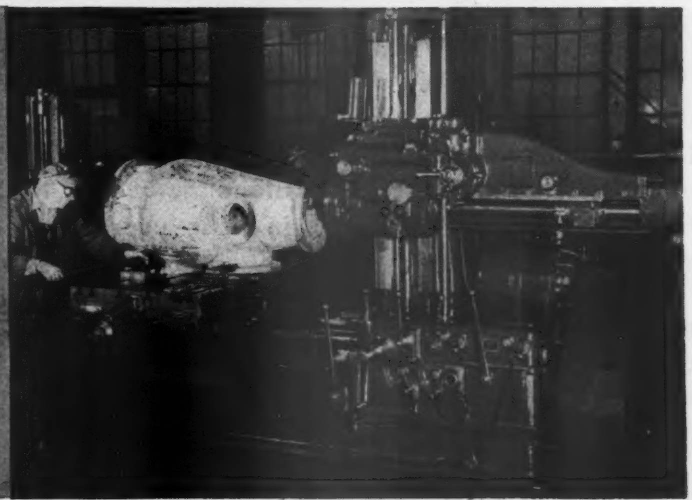

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IN 6 SIZES
30 INCH TO 74 INCH

Assured Accuracy and a Plus in manufacturing Economy. Simultaneous cutting with three heads.

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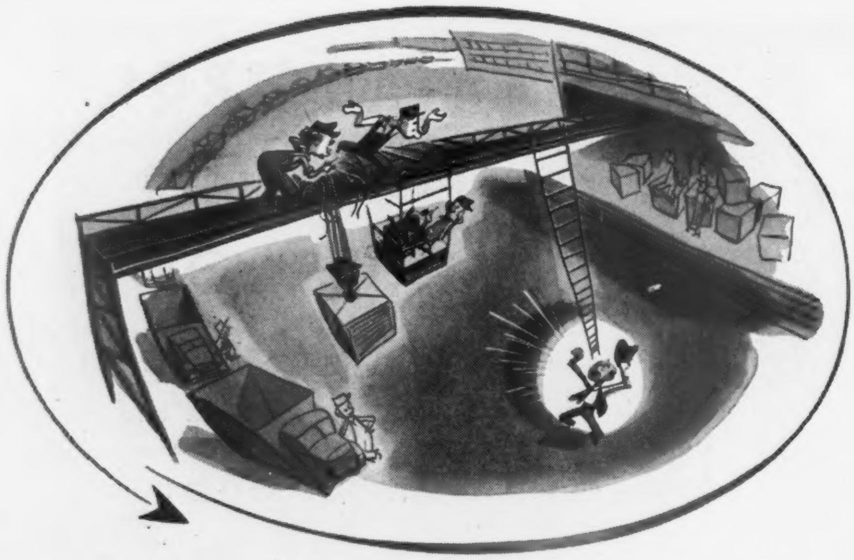

Burned-out Motors Waste Manpower!

Men without motors are just about as helpless in a modern factory as a wagon without wheels on a superhighway.

In many plants the failure of a single motor used to drive an overhead crane or a conveyor system can cost thousands of dollars an hour in lost production and wasted man-hours of labor.

The answer is Class H insulation made with Dow Corning Silicones. In a steel mill, for example, a cupola crane hoist motor insulated with the best Class B materials had an average life of only 50 days. Rewind costs alone amounted to $3,634 in three years. That motor, rewound with Class H Insulation at an extra cost of only $79 was still in good condition after 613 days on the hoist and 908 days on the trolley bridge.

And Class H is readily available. Most of the best rewind shops now feature this longer lasting, more reliable class of insulation. Leading motor manufacturers are quoting price and delivery on new Class H machines.

Dow Corning Silicones Mean Business!

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Please send me ☐ More Evidence ☐ List of Class H Rewind Shops ☐ List of Motor Manufacturers Offering New Class H machines. S-6

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Company____
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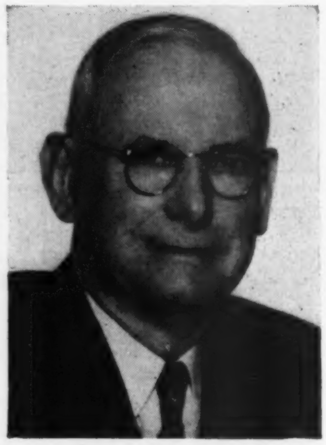
1924 and 1925 as a machinist helper. He was employed by the Scullin Steel Company from August, 1926, to May 1927, when he joined the M.P.'s test and inspection department as assistant chemist. Subsequently Mr. Meinholtz held various positions and in 1939 became assistant engineer of tests. From November, 1942, to October, 1945, he was on leave from the road serving with the U. S. Army as captain. When he returned to the M.P. in November, 1945, he continued as assistant engineer of tests. He was appointed engineer of tests in August, 1946.

L. R. Schuster, engineer, car construction, of the Southern Pacific, at San Francisco, Cal., has retired. Mr. Schuster was born at Napa City, Cal., March 12, 1883,



L. R. Schuster

and studied mechanical engineering through a correspondence school course. He started his career in December, 1901, in the passenger car department of the S. P. at Sacramento, Cal., later holding the positions of draftsman; assistant chief car draftsman and chief car draftsman before being appointed engineer, car construction in 1940.

W. W. Matzke, assistant to chief mechanical officer of the Chicago & North Western, has been appointed to chief mechanical engineer.

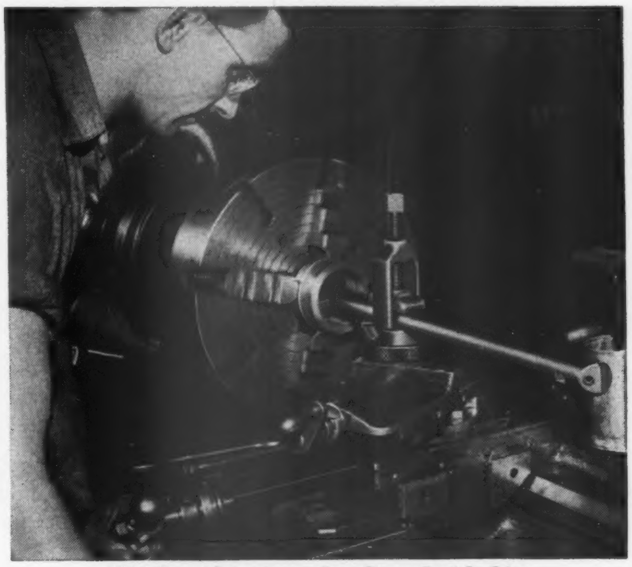
W. P. Miller, superintendent diesel and motor car equipment, of the Chicago & North Western at Chicago has been appointed assistant to chief mechanical engineer at Chicago.

E. H. Weston, mechanical engineer of the Chicago & North Western at Chicago has been appointed assistant chief mechanical engineer.

Norman A. Passur, supervisor, car construction, of the Southern Pacific, has been appointed engineer, car construction, with headquarters at San Francisco, Cal. Mr. Passur entered the service of the S. P. in April, 1919, as a junior draftsman, and later became draftsman. He was appointed air-conditioning engineer at San Francisco in 1936, and in 1939 was transferred to Chi-

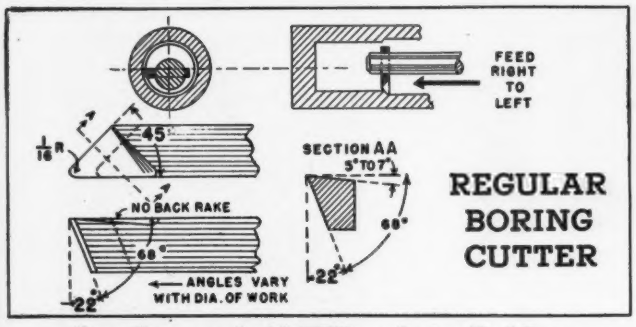
Memo to mechanics

How to do it *right* with WILLIAMS BORING TOOLS



Height of bars is easily adjusted with this Williams Boring-Tool Post

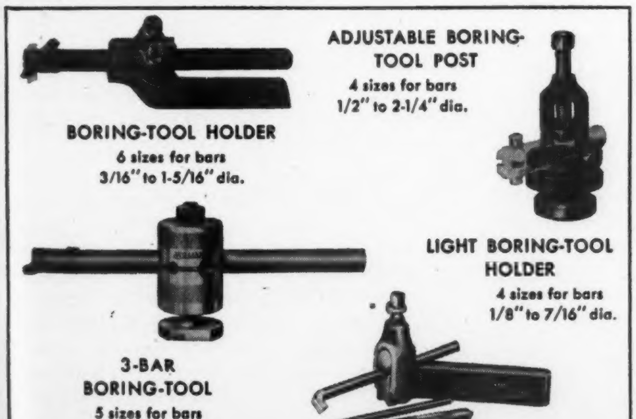
Boring Tools of this type, as opposed to drills and reamers, are used for machining internal surfaces and their operation might be described as *inside* turning. The cutters differ from outside turning tools in that they must be ground with more front clearance to prevent the heel of the tool from rubbing. Recommended grinding angles and proper application of tools to work are graphically explained in the three diagrams.

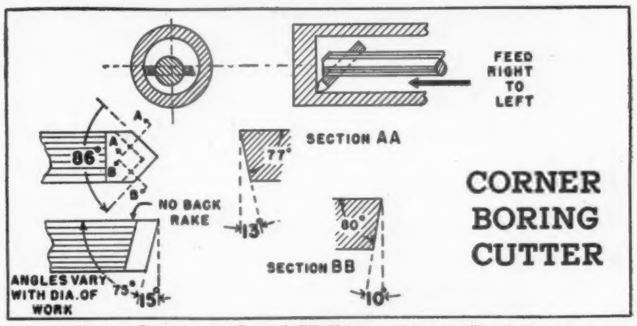


Above Cutter used with Williams Boring-Tool Posts, Holders and 3-Bar Boring-Tools

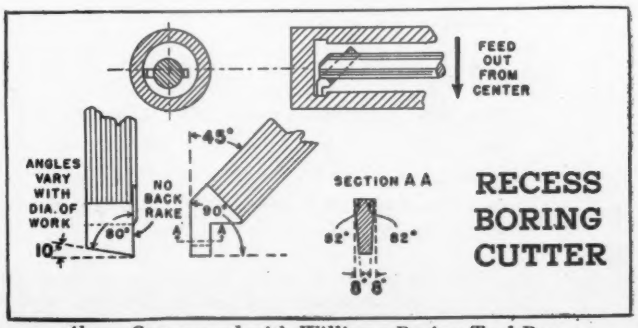
There are four types of Williams Boring Tools as illustrated below. Bars and Cutters are interchangeable in all except the Light Boring-Tool Holder. Depth of hole, of course, determines the length of bar required. When using long bars, remember that the increased overhang makes the tool more likely to spring and correspondingly lighter cuts should be taken.

Copies of this and other "Memos to Mechanics" are available free upon request.





Above Cutter used with Williams Boring-Tool Posts, Holders and 3-Bar Boring-Tools



Above Cutter used with Williams Boring Tool Posts, Holders and 3-Bar Boring-Tools

OPEN END, BOX, ADJUSTABLE & RATCHET WRENCHES; DETACHABLE SOCKETS & SETS; IMPACT SOCKETS; TOOL HOLDERS; LATHE DOGS; "C" CLAMPS; CHAIN PIPE TONGS & VISES; FLANGE JACKS; PLIERS; SCREWDRIVERS; PUNCHES & CHISELS; SOFT FACED HAMMERS; HOIST HOOKS; EYE BOLTS; ROD ENDS; CRANK & BALANCE HANDLES; THUMB SCREWS & NUTS; BODY & FENDER TOOLS.

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Mechanical Agitation Gives You Cleaner Parts Faster

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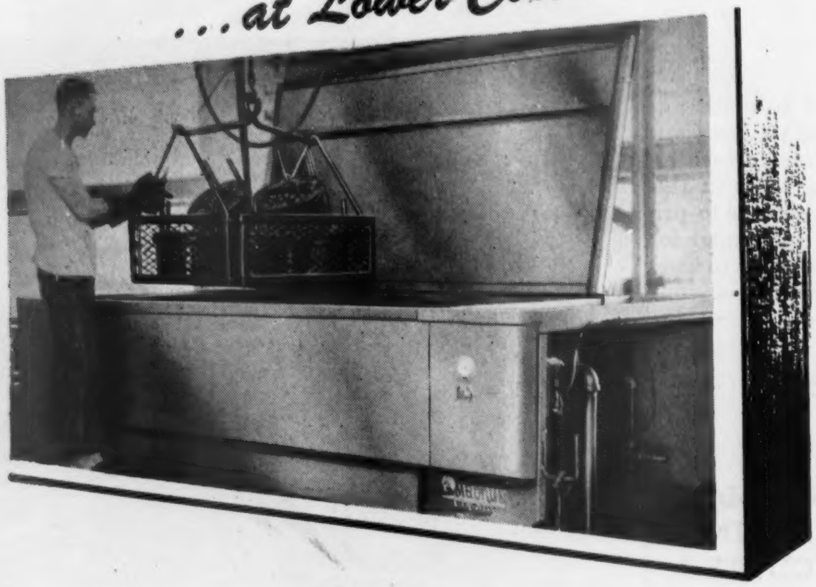

Get the vastly improved results of the *mechanical* cleaning provided by Magnus Aja-Dip Machines. While the cleaning solution is softening soil deposits, the *work itself* is moved up and down in the solution many times a minute, so that there is a vigorous flushing and shearing effect on all the dirt deposits, especially in interior areas not readily reached by plain soaking or ordinary agitation.

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Magnus Aja-Dip Cleaning Machines insure strikingly large savings in time over all other methods of cleaning. For example, you can clean heads in 1½ hours, liners in 2 hours, rods, pistons and blowers in 20 minutes, and other parts in from 5 to 15 minutes. And clean them far better, with virtually no hand work! These machines are in use today by roads constituting over 60% of the diesel horsepower on railroad work.

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More and more roads are turning to the Aja-Dip Machine for cleaning air filters. The standard unit for this purpose will clean 36 small filters (9"x 20"x 2¼") or 18 large filters (20"x 22"x 2¼") in *two minutes*. Spick and span clean, through and through, ready for drying and oiling

Write for complete details on the kind of economies in time you can obtain with Aja-Dip Cleaning Machines.

Railroad Division

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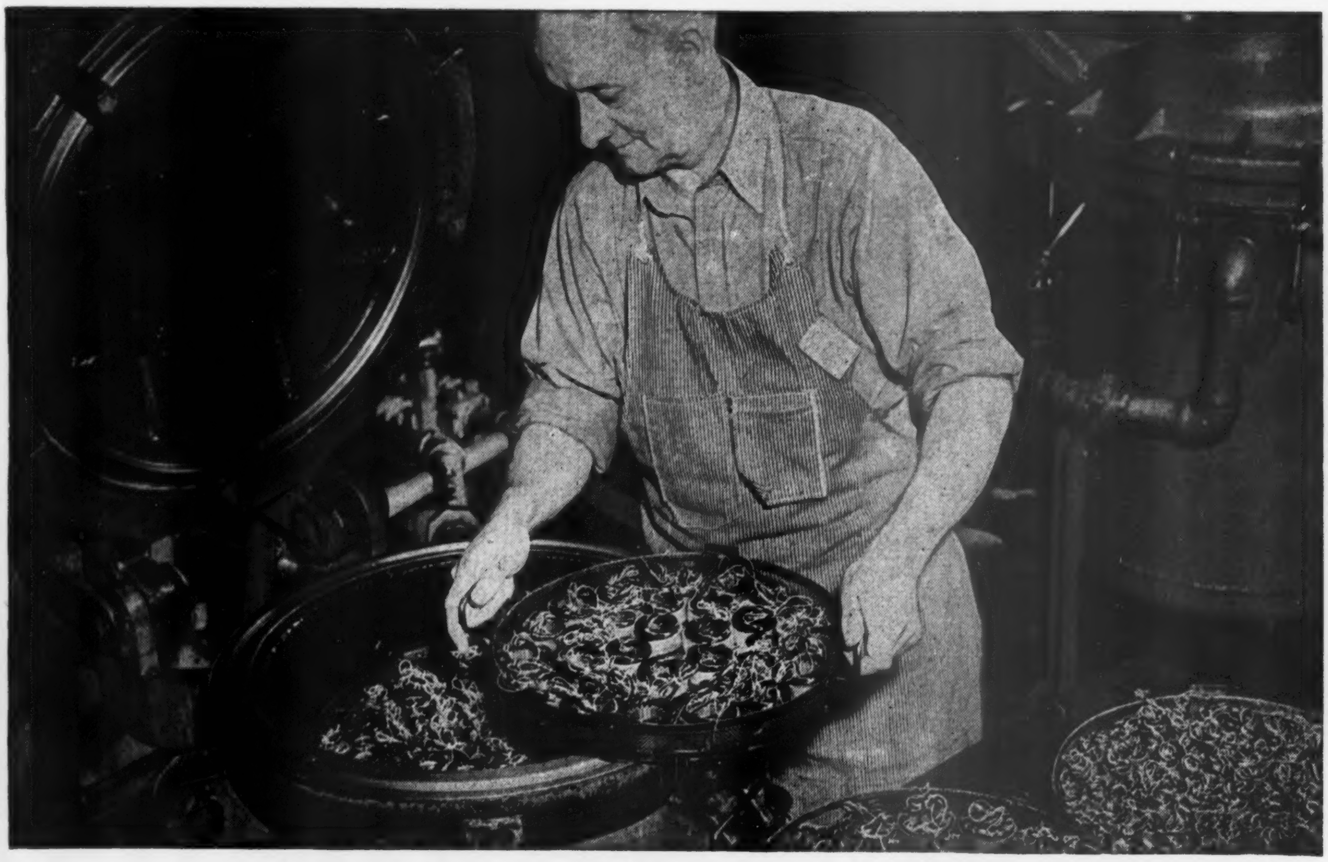
cago to help supervise construction of the S.P.'s second pair of "Daylights." After service in the Military Railway Service, first as captain and later as major, from 1943 to 1946, Mr. Passur returned to the S. P. as assistant engineer, car construction. He became supervisor, car construction, in 1948.

Philip H. Hatch, who has retired as general mechanical superintendent of the New York, New Haven & Hartford at New Haven, Conn., as announced in the May issue, was born in Albany, N.Y., on May 25, 1899, and attended Massachusetts Institute of Technology (BS. 1921). He was a student engineer with General Electric Company at Schenectady, N.Y., during 1921-1922; entered railroad service in 1922 as computer with the Cleveland Union Terminals at Cleveland, Ohio, and joined the New Haven in 1923, serving successively as special apprentice, electrical inspector, engineering assistant, engineer automotive equipment, assistant engineer and engineer electric and automotive equipment. He was appointed assistant mechanical engineer in 1941, mechanical engineer in May, 1944, and general mechanical superintendent in November, 1944.

Phillip H. Hatch

H. S. McTeer, who has been appointed superintendent of motive power and car equipment of the Quebec district of the Canadian National at Quebec, Que., was born at Quebec, where he began his railway service at the C.N.'s St. Malo shops as a messenger in 1919. After his apprenticeship, he became a machinist and served at Quebec, Joffre, Limoilou and Montreal. In 1940 he was appointed inspector at the company's shops at Toronto, Ont., and later the same year was appointed assistant foreman at London, Ont. In 1941 he moved to Hornepayne, Ont., as locomotive foreman, and two years later was transferred to Limoilou.

Kenneth Cartwright, who has been appointed general mechanical superintendent of the New York, New Haven & Hartford at New Haven, Conn., as announced in the May issue was born at West Epping, N. H., on March 14, 1890. He attended Massachusetts Institute of Technology (B.S. 1912)



For *lasting* insulation strength, Sperry counts on HARVEL 912-C

For more than 10 years, Sperry Gyroscope Company has been insulating coils and other components with Harvel Internal Curing Varnishes, because of their excellent mechanical and electrical properties. Sperry . . . world famous for the quality and performance of its instruments . . . reports these specific advantages from the use of Harvel 912-C, electrical insulating varnish:

1. ***High mechanical strength.*** Conductors rigidly bonded into a compact mass. No soft, tacky varnish interiors to allow movement of conductors.
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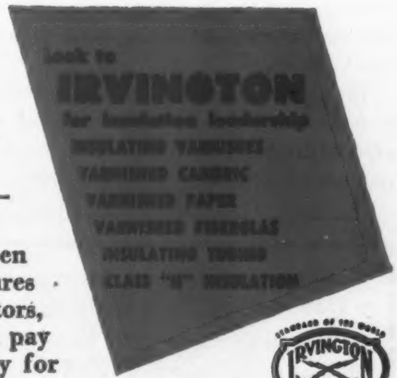
3. ***Fast baking time.*** 912-C cuts baking schedules as much as 50%—materially reduces production costs.

Sperry also turns to Irvington for Class "H" flexible insulations when space and weight are at a premium. Running safely at temperatures as high as 500°F, these insulations permit using smaller conductors, and thus open the way to lighter, more compact designs. It will pay *you* to investigate these Irvington products—mail coupon today for the full story.



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NUMBER 5 OF A SERIES

BIDDLE

Instrument News

ONE PORTABLE TEST KIT FOR MOST ELECTRICAL RESISTANCE MEASUREMENTS

Here is how one railroad uses a Rectifier-Operated Meg Type of Megger® Insulation Tester housed in the same portable carriage with a Ducter® Low Resistance Ohmmeter and a Biddle Power Supply.

Photo courtesy Santa Fe Railway

The bar-to-bar test on the armature is being made with the Ducter using duplex hand spikes having a current and potential spike in each handle. In general bar-to-bar tests are more for the purpose of equalizing the resistances than for measuring their exact values.

The Ducter ohmmeter, which measures resistances as low as a millionth of an ohm, is invaluable for maintaining normal resistances in the series fields and armature windings of diesel-electric locomotive traction motors, switch contacts, cable joints, etc. Write for our interesting Bulletin 24-25-X or the comprehensive Ducter Manual 24J25-X.

The Rectifier-Operated Meg Type of Megger Insulation Tester is included in the same mobile unit for ready use in testing electric motive and Diesel-electric motive power equipment as well as motors, generators, transformers, etc. These instruments, available in ranges up to 2000 megohms and 1000 volts d-c, are described in Bulletin 21-46-X.

We are constantly publishing new technical bulletins on Biddle Instruments. A complete list of our latest bulletins will be mailed you on request, so that you may check it to bring your files up-to-date.

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ELECTRICAL TESTING • SPEED MEASURING INSTRUMENTS • LABORATORY & SCIENTIFIC EQUIPMENT

Kenneth Cartwright

and entered the employ of the New Haven on June 1, 1914, as material inspector at New Haven. After service in the United States Navy as lieutenant, j.g., he returned to the New Haven and served, successively, as assistant to engineer of tests, chief shop inspector, general mechanical inspector, assistant mechanical engineer and mechanical engineer. From September to November 1942 Mr. Cartwright was on leave of absence to study motive-power and rolling-stock requirements for the Vitoria a Minas Railway in Brazil. He was appointed chief mechanical engineer of the New Haven on April 1, 1944.

E. E. Gleason, chief mechanical officer of the Western Pacific, has been given supervision of the Mulberry shops of the Sacramento Northern at Chico, Cal., which are being consolidated with the Sacramento shops of the parent Western Pacific. The consolidation results from the conversion of both roads to diesel-electric power—the W. P. from steam, the S. N. from interurban electric operation.

J. H. Miller, of the mechanical department of the Toronto, Ont., Transportation Commission, has been appointed chief mechanical officer of the Quebec North Shore & Labrador, a new railway.

Diesel

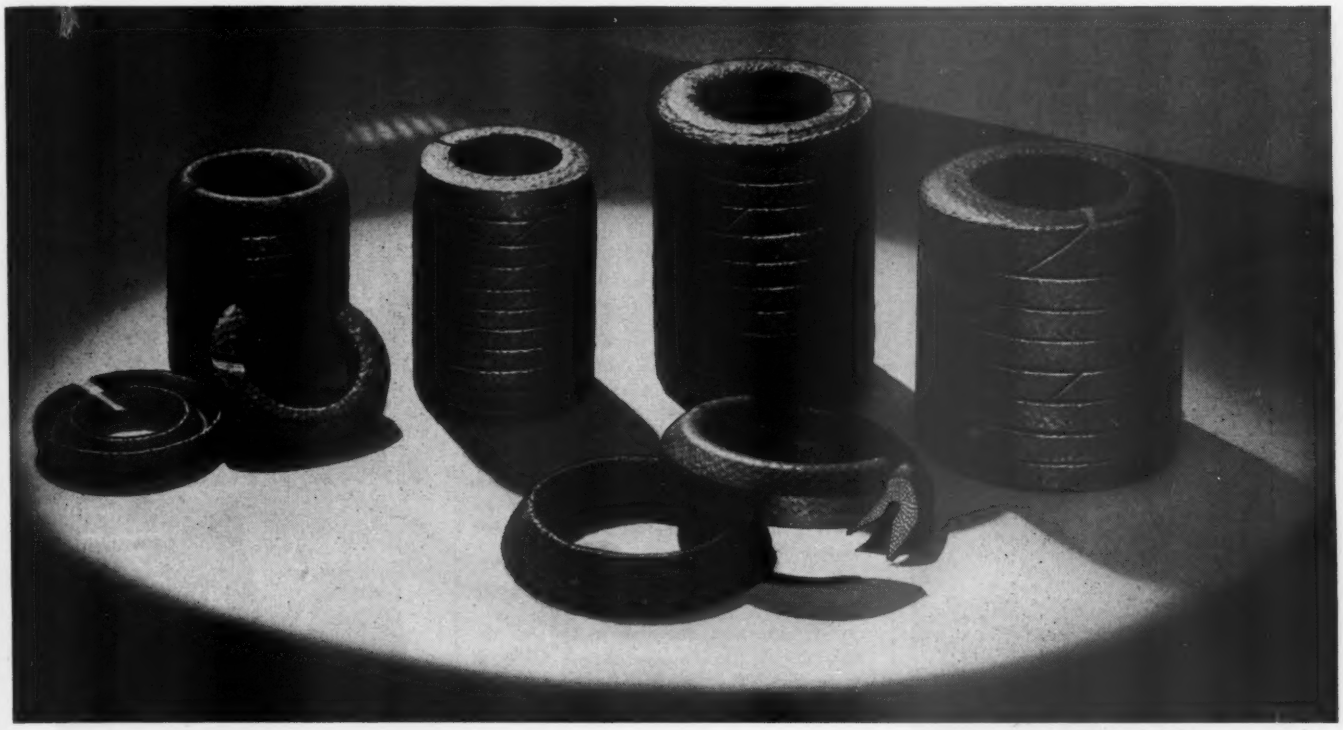
A. M. Hagen, also division master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Milwaukee, Wis has been assigned jurisdiction over all diesel locomotive maintenance at Milwaukee.

H. C. Pottsmith, assistant division master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at LaCrosse, Wis., has been appointed a general diesel supervisor at LaCrosse.

Homer Fuller, motive-power inspector of the Chesapeake & Ohio at Huntington, W. Va., has been appointed assistant supervisor diesel operation, with headquarters at Richmond, Va.

I. R. Diehl, gang foreman of the Chesapeake & Ohio at Huntington, W. Va., has been appointed diesel electric supervisor at Richmond, Va.

(Continued on page 118)



GARLOCK 530 *Chevron* Throttle Packing.

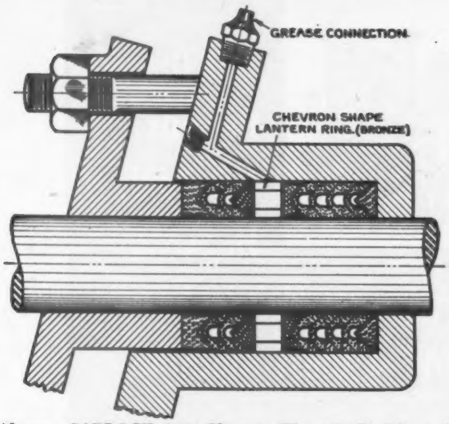
CHEVRON

Throttle Packing

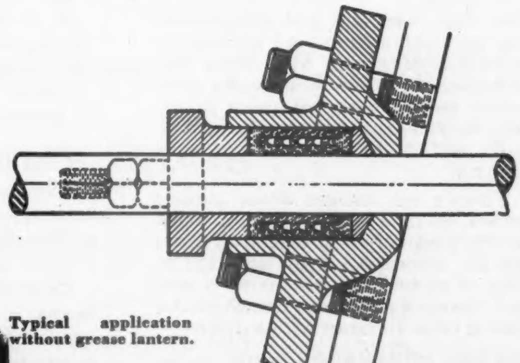
—*for Efficiency and Economy*

The use of Garlock *Chevron* locomotive throttle packing has increased efficiency and has effected substantial reductions in packing costs on many railroads. The exclusive hinge-like construction of the *Chevron* rings allows the packing to expand and contract and reduces friction to a minimum. Very little gland pressure is required. The result is a leakless, easy-operating throttle.

When installed with a grease lantern ring and a connection for a grease gun, a lubricant can be injected into the stuffing box. This makes for longer packing life and increases the ease with which the throttle can be opened and closed. Standardize on *Chevron* for your locomotive throttles!



Above: GARLOCK 530 *Chevron* Throttle Packing with grease lantern.



Typical application without grease lantern.

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CLEAN
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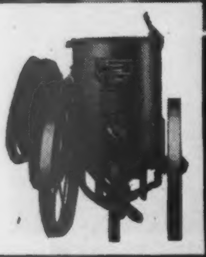

NO Drying Periods, NO Toxic Hazards

with NEW Pangborn AC-4 Blast Machine

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There's no danger from caustic action, no time lost waiting for work to dry. Corncob blast machines operate on standard 40-lb. air supply. Cost of materials averages 90% less and cleaning is done in one-third the time it takes to clean with solvents.

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Look to Pangborn for the latest developments in Blast Cleaning and Dust Control equipment

Pangborn

BLAST CLEANS CHEAPER

with the right equipment for every job

(*Continued from page 116*)

J. E. Hall, Jr., motive-power inspector of the Chesapeake & Ohio at Clifton Forge, Va., has been appointed supervisor diesel operation, with headquarters at Richmond, Va.

H. H. Workman, equipment inspector of the Chesapeake & Ohio at Clifon Forge, Va., has been appointed general diesel supervisor at Richmond, Va.

Walter E. True, mechanical inspector at the Boston (Mass.) Diesel Terminal of the Boston & Maine, has been appointed acting assistant foreman at Mechanicville, N. Y., diesel terminal.

William J. White, assistant general diesel foreman of the Boston & Maine at Mechanicville, N. Y., has been appointed assistant general diesel foreman at Boston (Mass.) diesel terminal.

Car Department

H. N. Thomas, foreman in the car department of the Chesapeake & Ohio at Huntington, W. Va., has been appointed general passenger car inspector at Huntington.

O. Borgeson, mechanical engineer of the Chicago & North Western at Chicago has been appointed engineer car maintenance.

Ewing C. Shelly has been appointed assistant general foreman car repairs of the Southern at Birmingham, Ala.

Vernon C. Henry has been appointed foreman freight car repairs of the Southern at Valdosta, Ga.

Joseph D. Campbell has been appointed foreman freight-car repairs of the Southern at Birmingham, Ala.

Master Mechanics and Road Foremen

W. H. Marshall, general foreman of the Chesapeake & Ohio at Newport News, Va., has been appointed assistant master mechanic at Newport News. The position of general foreman has been abolished.

Cecil D. Schwine, Jr., general foreman on the Southern at Chattanooga, Tenn., has been appointed assistant master mechanic at Birmingham, Ala.

Lawrence J. Brasher, assistant master mechanic of the Belt of Chicago, has been appointed master mechanic, with headquarters at Clearing Ill.

W. R. Downs, master mechanic of the New York Central at Avis, Pa., has retired after 47 years of service.

F. A. Upton, division master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Miles City, Mont., transferred to Chicago as master mechanic.

E. Pool, district master mechanic of the Eastern district of the Erie at Jersey City, N. J. has retired.

(*Continued on page 120*)

INSTANT, DIRECT Temperature Readings Accurate to within a Fraction of a Scale Division with

XACTEMP

Trade Mark Reg. U. S. Pat. Off.

HAND PYROMETERS

For All-around General Temperature Checking

Specify XACTEMP PYROMETERS wherever a quick, accurate temperature determination is needed. Used for surface temperatures of welds, welded rail ends, billets, slabs, heated rollers, forgings, ovens, hot plates, furnace walls—for general inspection in furnaces, lead and salt pots, galvanizing tanks, core ovens, type metal, etc. Long-life cast aluminum and brass construction. Medium resistance, fast-acting indicator, provided with Alnico V magnet—direct reading dial starts at 50° F. or 60° F. Simple, easy to operate—no adjustments necessary—always ready for use. Will take most types of thermocouples. A full line of thermocouples available from stock.

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LT 800	60-800 F.	Iron-Constantan
LT 810	60-1200 F.	Iron-Constantan
LT 820	60-1600 F.	Iron-Constantan
LT 830	50-2500 F.	Chromel-Alumel

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Fine commutators . . YES!

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This brush has a special, no-fray shunt cable. It has a unique, vise-tight shunt connection.

This brush is it, and you can get it, under National's unique standardization program, for the same low, flat price, whether you buy 1 box or 10,000 boxes. You get the best brush money can buy and you save money in the bargain. For complete information, write to National Carbon Company, A Division of Union Carbide and Carbon Corporation.

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District Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco

SLASH BATTERY COSTS IN HALF!

With the revolutionary new "Eveready" No. 1050 Flashlight Battery, you get these big exclusive features:

- More than twice as much light
- Whitest, brightest light available from a flashlight battery
- Half the cost for light output
- Leakproof — No metal can to leak or corrode
- Will not swell, stick or jam in a flashlight

Why? Because of "Eveready" No. 1050's exclusive "inside out" construction. Instead of being the container for the cell, the zinc electrode is on the inside to make the battery last longer, while the new outside carbon jacket makes the battery leakproof. ***Order a supply of No. 1050's today.***

L. H. RABUN, district master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Chicago, has been transferred to the position of master mechanic at Miles City, Mont.

E. L. GROTE, division master mechanic of the Chicago, Milwaukee, St. Paul & Pacific, at Mason City, Iowa, has been transferred to Minneapolis, Minn. The position of division master mechanic at Mason City has been abolished.

W. W. HENDERSON, division master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Savanna, Ill., has had his jurisdiction extended to include Sioux City, Iowa, and Calmar.

W. W. BATES, division master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Milwaukee, Wis., has had his jurisdiction extended to include that part of the LaCrosse and River division from Milwaukee to LaCrosse and from New Lisbon, Wis., to Woodruff.

F. L. KING, division master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Milwaukee, Wis., has been given jurisdiction over all steam locomotive maintenance at the point as well as the foundry.

J. H. KASMEIER, master mechanic of the Chicago division of the Chicago, Rock Island & Pacific, has been transferred to Fort Worth, Tex.

W. G. CARLSON, master mechanic of the Erie at Hornell, N. Y., with jurisdiction over the backshop, has been appointed district master mechanic of the Eastern district at Jersey City, N. J. The position of shop superintendent at Hornell has been abolished.

J. J. BACHUS has been appointed master mechanic of the Chicago division of the Chicago, Rock Island & Pacific.

E. BRANNING has been appointed master mechanic of the Erie at Hornell, N. Y.

Shop and Enginehouse

JAMES W. ADAMS has been appointed to general master mechanic of the Louisville & Nashville, at Louisville, Ky. Mr. Adams began railroading with the L. & N. as a machinist in July 1922. From 1926 to 1939 he served as president

James W. Adams

of the Association of Maintenance of Equipment Employes, subsequently acting as schedule foreman and erecting foreman for the L. & N. at South Louisville, Ky. He became assistant to superintendent at Louisville in July 1943, and assistant superintendent in January 1948.

F. H. WILBOURNE, gang foreman of the Norfolk & Western at Petersburg, Va., has been appointed foreman at Lynchburg, Va.

B. A. DENNARD has been appointed enginehouse foreman (night) of the Southern at Chattanooga, Tenn.

W. E. EMMONS, gang foreman at the Petersburg, Va., shop of the Norfolk & Western has been appointed foreman at Durham, N. C.

T. F. CALLANAN, boiler foreman at the Meadows, N. J., enginehouse of the Pennsylvania, has been appointed enginehouse foreman at Meadows.

R. W. LLEWELLYN, foreman, electrical department of the Chesapeake & Ohio at Newport News, Va., has been appointed general foreman-piers at Newport News.

W. L. HEGERFELD, foreman at the Conway, Pa., enginehouse of the Pennsylvania, has been appointed foreman at the 46th street, Philadelphia, Pa., enginehouse.

CONTINUOUS SCIENTIFIC LABORATORY DEVELOPMENT

CONSTANT ON-THE-JOB PERFORMANCE TESTS...

Result! Felpax Lubricators Reduce Support Bearing Maintenance as much as 75%.

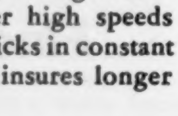
INSTANT COMPLETE LUBRICATION with the first turn of the axle under heavy load conditions reduces babbit wipe and consequent early bearing damage. Continuous lubrication under high speeds provided by special felt wicks in constant contact with the journal insures longer bearing life.

MILLIONS OF MILES of trouble-free service on the nation's Class I Railroads have proved Felpax Lubricators provide the lubrication required to keep Today's Modern Traction Motors operating at peak efficiency.

NO OTHER LUBRICATION METHOD provides all these *"Performance Proved"* FEATURES!

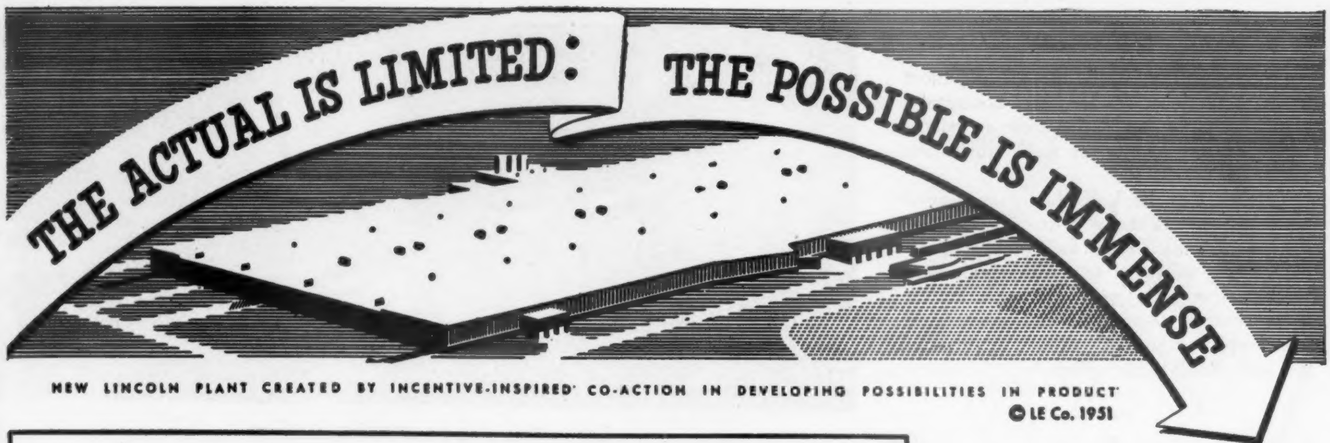
- **ELIMINATES** waste packing and the human element involved.
- **SERVICE** reduced to periodic checking and filling oil sump.
- **SPECIAL FELT WICKS** eliminate waste grabs and starved bearings.
- **REPLACEMENT** of worn wick sets after thousands of miles of use is simplified by improved construction (see illustration above).
- **COMPLETE KIT** for replacement containing wick set, springs and necessary hardware available at nominal cost.
- **NO MOVING PARTS** subject to failure due to dirt, moisture and freezing.

For full particulars see your locomotive builder or write to:



Miller Felpax Corporation

MILLER FELPAX LUBRICATOR



NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT

© LE Co. 1951

SIMPLIFIED REPAIRS SAVE COSTLY MAN-HOURS

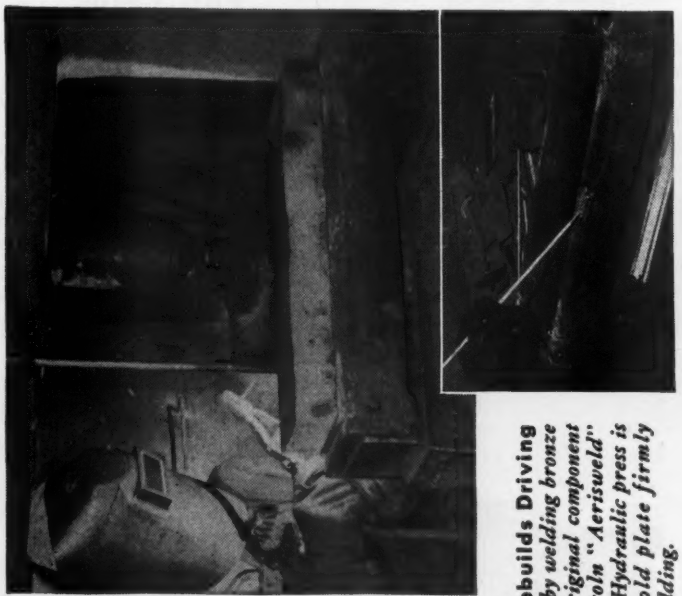


Fig. 3. **Rebuilds Driving Box Shoe** *by welding bronze plate to original component with Lincoln "Aerisweld" electrode. Hydraulic press is used to hold plate firmly during welding.*

UTILIZING the economies of maintenance arc welding enables repair shops to handle their ever increasing volume of locomotive work even more effectively. Many time-consuming jobs are being side stepped with fast, simple welded repairs . . . to get equipment back in service faster and at less expense.

Worn surfaces are reconditioned by building up with weld metal or by adding bearing plates as shown. Where difficulties are encountered in obtaining conventional replacement parts, components can be redesigned for welded steel fabrication, often saving weeks of delay, as well as critically scarce man-hours.

GETS GREATER STRENGTH

Fig. 1. Railroad Back Shop *replaces buffer casting by welding replacement unit to locomotive frame with Lincoln "Shield-Arc 85."*

AND LONGER SERVICE

Fig. 2. Installs New Mud Ring *by fillet welding replacement tubing to locomotive plate with "Fleetweld 5."*

SEE HOW THIS SHOP CUTS ITS REPAIR COSTS

For further information about arc welding procedures and equipment, write The Lincoln Electric Railway Sales Co., 11 Public Square, Cleveland 13, Ohio. Railroad representatives of

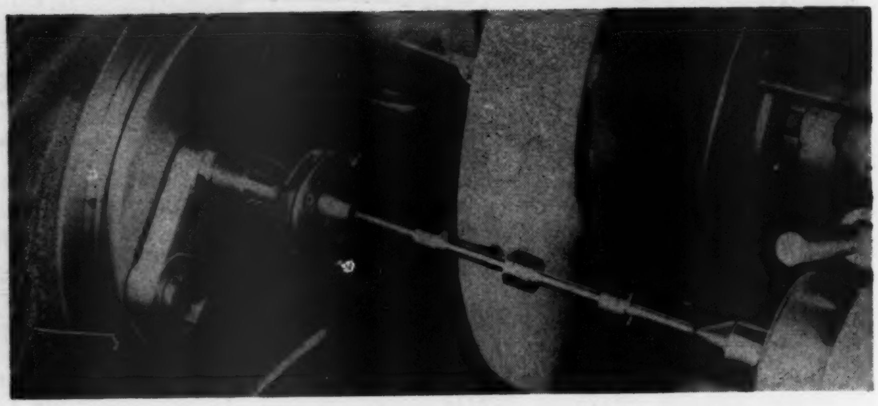
THE LINCOLN ELECTRIC COMPANY

CLEVELAND 1, OHIO

(Continued from page 89)

edges. Its ability, states the manufacturer to cut a single or double bevel accurately, recommends it for utilization in shops which do any amount of steel fabrication work.

Torches may be individually positioned vertically or laterally without changing the bevel angle. Fuel and preheat pressures are initially set with individual torch valves, and once set, the master valve controls turning-on and shutting-off gas supply without disturbing settings of the individual torch valves.



Cam action dog on grinding machine

Cam Action Dogs

On semi-automatics and on units where there is little traverse feed, the Ready Tool Co., Bridgeport, Conn., claims their cam action grinder and lathe dog will increase production and efficiency by saving time and labor. These devices are easy to adjust with instant, positive action. A concealed spring holds the cam to the work.

For grinders, the cam face is ground smooth, both surface and contour, protecting work from mars, thus eliminating spoilage and rejects. For lathes, the cam face is serrated to prevent slipping.

Construction is of steel with specially hardened cam face and set screws. The dogs are also available with brass cam and screws for use on grinding machines.

Use of the dog saves time; all that is required is to place the work in the dog, holding the cam against the spring tension with a finger, and set the two screws. When the cam is released, the work is held securely by the cam spring action. To remove the piece, just release the cam. Sizes are made to accommodate diameters from ⅛ to 6 in. capacities.

Full Vision Safety Goggles

To accommodate smaller faces, the American Optical Co., Southbridge, Mass., has developed the type 800 Panoram acetate safety goggle as a companion to their larger 600 Panoram style.

This goggle has replaceable plastic lenses that give shatterproof protection and undistorted vision. Comfort is provided by a lightweight plastic frame conforming closely to the forehead and face.

The eyecups combine protection with the necessary ventilation and have a wide protective area and an extensive visual field laterally for the wearer. These eyecups conform closely to the facial contours and all face contacting surfaces are broad and smooth.

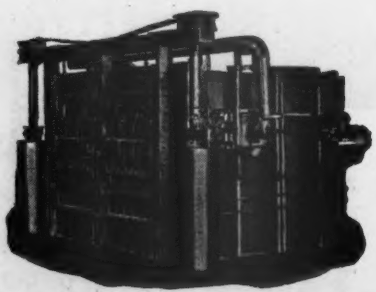
Lenses may be replaced easily by unscrewing the clamp nut at the top of the center swivel rod. When loose, the frame snaps back allowing the lenses to slip out. This clamping nut stays on the post and cannot be lost.

Goggles may be purchased with green or clear lenses and green or clear frames. Both goggle sizes are supplied with a rubber headband in place of the former elastic.

Circular Milling Attachment

For use with their smaller knee-type milling machines, circular or rotary milling attachments have been announced by The

To Serve
STEAM HAMMERS
FORGING PRESSES
BULLDOZERS



JOHNSTON

DOOR TYPE FORGING FURNACES

Johnston Door Type Forging Furnaces are unusually rugged, featuring heavy frame steel cased construction with walls 13½" or 18" thick. There is ample venting, and uniform distribution of heat. Johnston Reverse Blast low pressure burners for oil or gas assure rapid heating, and low cost of operation. Sizes and door arrangements built to suit. Send information on work to be done and we will be glad to make our recommendations.

OVER THIRTY YEARS EXPERIENCE IN THE DESIGN AND MANUFACTURE OF

BURNERS BLOWERS FURNACES RIVET FORGES
FIRE LIGHTERS TIRE HEATERS ALLIED EQUIPMENT

SAFETY THE JOHNSTON LINE DEPENDABILITY

JOHNSTON MANUFACTURING CO.
2825 EAST HENNEPIN AVE
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ENGINEERS & MANUFACTURERS OF INDUSTRIAL HEATING EQUIPMENT

STANDARD ENGINEER'S REPORT

DATA

LUBRICANT *RPM Delo R.R. Oil*

UNIT *Locomotive diesel engines*

SERVICE *Freight and passenger*

OPERATION *Local and transcontinental*

MAINTENANCE *Progressive*

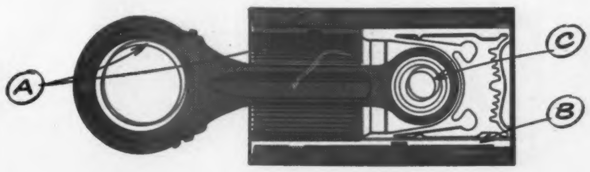
One million miles of service from engine parts!

LUBRICATED WITH RPM DELO R.R. OIL, many diesel engines in the locomotives of U.S. railroads have been in service for long periods without complete overhaul! Many of the liners, pistons, bushings and other parts in these engines have now been in use for hundreds of thousands of miles. Progressive maintenance inspections indicate that RPM DELO R.R. Oil will keep the parts in service for at least one million miles, the general overhaul period set by some of the railroads.

RPM DELO R.R. Oil keeps parts clean and free of wear-causing lacquer and gum deposits and is not corrosive to engine metals of any kind.

IN OVERLAND MOUNTAINOUS FREIGHT SERVICE for nearly 500,000 miles, this liner, lubricated with RPM DELO R.R. Oil has less than 0.006 inch wear and taper is so minor that it is barely measurable.

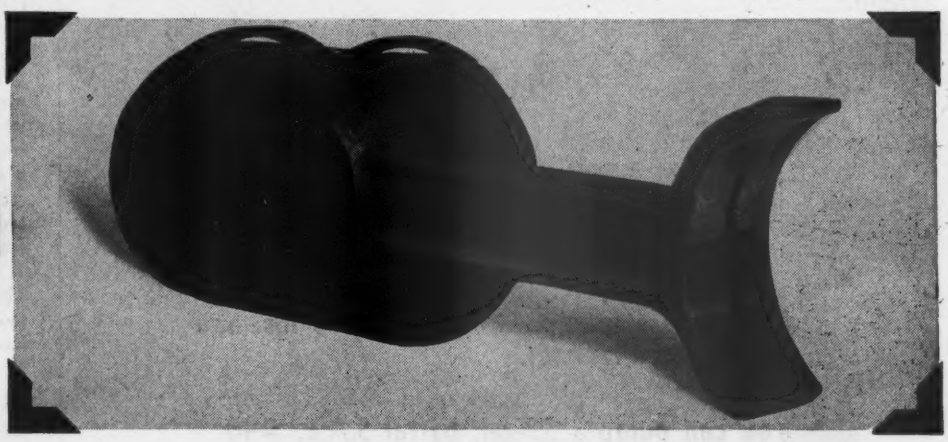
How RPM DELO R.R. Oil prevents wear, corrosion, oxidation



A. Special additive provides metal-adhesion qualities...keeps oil on parts whether hot or cold, running or idle.

B. Anti-oxidant resists deterioration of oil and formation of lacquer...prevents ring-sticking. Detergent keeps parts clean...helps prevent scuffing of cylinder walls.

C. Special compounds stop corrosion of any bushing or bearing metals and foaming in crankcase.



THIS PISTON AND CONNECTING ROD have been in service for more than four years. After picture was taken it was put back in the engine for further use. Note the excellent condition of the rings and bearing. All the rings are free, oil holes open and there are no troublesome deposits in any ring grooves.

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor handling them, write or call any one of the companies listed below.

RPM DELO LUBRICATING OILS

TRADEMARK "RPM DELO" REG. U.S. PAT. OFF.

STANDARD OIL COMPANY OF CALIFORNIA • San Francisco
THE CALIFORNIA OIL COMPANY • Barber, N.J., Chicago, New Orleans
STANDARD OIL COMPANY OF TEXAS • El Paso, Texas
THE CALIFORNIA COMPANY • Denver, Colorado

Manual feed table

Power feed table

Cincinnati Milling Machine Co., Cincinnati 9, Ohio. They are intended primarily for toolroom work, but when properly tooled up become efficent high production units for performing milling operations on small parts.

The attachments are built in two styles: manual feed and power feed. For both styles, the table is 12 in. in diameter, machined with four standard $\frac{9}{16}$ in. T-slots; rotated through a worm and wheel having 80 to 1 ratio; and graduated in deg. on its circumference. The handwheel dial is graduated in min.

The power feed attachment is driven by the machine on which it is mounted. A shaft beneath the table and parallel to the feed screw drives a gear train within the bracket attached to the right-hand end of the table. Power is transmitted from the gear train to the attachment by a universal jointed, telescoping shaft. A reverse clutch arrangement permits the table to be driven clockwise or counter-clockwise, or disengaged for manual rotary adjustment.

Both manual and power driven styles may be equipped with an auxiliary indexing attachment. This unit employs the same index plate as standard Cincinnati dividing heads. Other sizes of 16, 20 and 24 in. table diameters are also available.

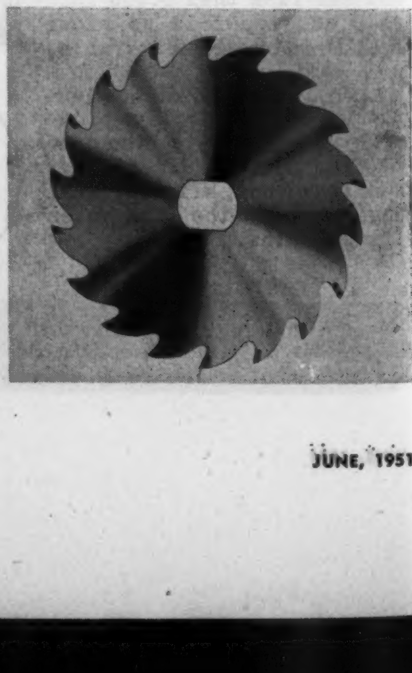
Carbide-Tipped Saw Blades

The introduction of carbide-tipped blades for their line of "Quick-Saw" portable electric saws has been announced by the Black & Decker Mfg. Co., Towson, Md.

The illustrated blade cuts faster than abrasive discs when sawing transite, cemesto board, masonite, formica and other abrasive or plastic composition materials. By test, it cuts ½-in. transite eight times faster than an abrasive disc. On 1- and 2-in. cemesto board, this blade cuts twelve times faster.

The device can be utilized for cutting wood bcause it has a special tooth design which makes a smoother cut than standard steel blades. After extensive field testing, it is estimated that a carbide-tipped blade stays sharp thirty times longer than standard blades and loses less diameter in the resharpening process.

They are available in three sizes: 7-in. (18-tooth), 8-in. (20-tooth) and 9-in. (22-tooth) and are designed to fit all recent model Black & Decker Quick-Saws.



Chicago North Western System
PRR
Illinois Central
Atlantic Coast Line
Union Pacific
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Rock Island

WILKINSON

High Speed Diesel Lube Oil Transfer Pump

REDUCE your Diesel lube oil handling time by more than 41% and eliminate oil spillage. Use the WILKINSON light-weight air-operated transfer pump. Only weighs 15 lbs. and **no air enters barrel.**

You can pump a 55-gal. barrel S.A.E. #40 lube oil in 5 minutes with only one man.

Can furnish ready-to-use,—package consisting of WILKINSON Transfer Pump, 35 feet of ¾" oil hose, and automatic shut-off valve.

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WILKINSON EQUIPMENT & SUPPLY CORP.
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CHICAGO 21 ILLINOIS